THE
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EDITORIAL.

In the three years since this Magazine was revived in its present form, we have tried to publish horticultural articles of as wide a variety as possible. There have been accounts of special groups of plants, of new and interesting plants, of trees and their treatment; articles on garden design and garden practice. We shall welcome any suggestions or criticisms from readers, and will do our best to meet any requests for articles on special topics.

We intend to follow up the articles on garden design by actual descriptions and photographs of interesting gardens or garden features, and we should be grateful for any contributions of this nature. The question of garden design is one which has made great strides in Europe in recent years, but modern tendencies are very slow in making themselves felt in Malaya. Perhaps this is because few people have the prospect of the possession of any one garden for long enough to warrant the expenditure of much time and money on re-designing it. There is the further difficulty of adapting ideas of design to suit local conditions.

Then there is the quite different question of adapting oriental ideas of garden design to Malayan conditions. Some success has been achieved on these lines by Chinese and Japanese residents, and we should be very pleased to have their views on the subject. Closely allied is the question of the adaptation of tropical woody plants to pot culture in the oriental fashion; this is a fascinating subject full of possibilities, and offering a wide field for experiment.

Undoubtedly gardening in Malaya is a very exacting business. It is an all-the-year-round job, and nature works so rapidly in plant growth, and in soil changes resulting from high temperatures and heavy rain, that, if we are to achieve really good results, a more intensive level of cultivation is needed here than in temperate climates. Even our lawns soon get out of condition unless they are regularly manured. Then we have the disadvantage that so many of the best flowering plants do not thrive; we have to be content with second best, and to find ways of coaxing our plants to behave as we wish. Add to all this the general conditions of life in Malaya, and it is perhaps hardly surprising that the average level of gardening practice is not what it might be.

Some people specialize on a few kinds of plants. It requires a real enthusiasm and much expenditure of time and thought to make and maintain

a good garden of a varied nature; but to make a collection of say Begonias, ferns, Bougainvilleas, or some other group of plants, is less exacting. There is scope for experiment in varying treatment without too great a range of requirements, and one can give all one's care to produce a limited number of fine plants. There is much interest in collecting all the different varieties of a single group of plants, and noting their peculiarities and differences of form and behaviour. We hope to cater for gardeners who are interested in making such collections, by publishing from time to time fairly full accounts of special groups. Some groups have already been dealt with; and we would remind readers that it may be worth their while to look up or purchase past issues of the Magazine for the sake of these accounts, which contain information not available elsewhere. But we must warn our readers not to expect too much, as a great deal of time is often required to gather together the necessary information about groups of plants which are native of other countries.

Malayan Christmas Hampers.

The scheme for the supply of Christmas Hampers of Malayan produce again proved an outstanding success, a total of 342 orders being received. Of this number 328 hampers were shipped to Great Britain the balance being distributed in Malaya, Australia and Canada.

While our hope of 400 orders was not fulfilled the actual number was gratifyingly high in comparison with the total of 236 in 1934 and 108 in 1933 when the scheme was first inaugurated.

THIRTEENTH MALAYAN EXHIBITION

Preliminary notice is given that the Annual Malayan Exhibition will be held this year during the August Bank holidays as usual, the 1st, 2nd and 3rd August. Fuller information respecting the Show will be given in subsequent issues of this Magazine.

ULU SELANGOR DISTRICT AGRICULTURAL SHOW, 1936

We are asked to insert a preliminary notice that the above District Show will be held on the 1st and 2nd June, 1936 in the Public Offices at Kuala Kubu Bharu.

Full information regarding the Show can be obtained from the Organising Secretary, District Office, Kuala Kubu Bharu.

Horticulture.

LENGTH OF DAYLIGHT AND FLOWERING

BY

R. E. HOLTTUM, M.A., F.L.S.
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In an article in this Magazine, Vol. 3, No. 1, I gave some account of the response of various plants to different lengths of day; the reader is referred to this article for further information. Briefly, some plants, such as the common orange Cosmos, will not flower if they receive more than about 13 hours of light daily, whereas other plants, such as *Rudbeckia laciniata*, will only flower if they have a day of at least 14 hours. This means that the long-day plants will never flower in Malaya, where the length of daylight is not much in excess of 12 hours at any season of the year.

In the *Journal of Agricultural Research* (Washington) Vol. 51 No. 1, issued July 1st 1935, is an interesting report of experiments on the flowering of *Bougainvillea glabra* under various lengths of daylight. The behaviour of another plant known to Malayan gardeners, *Hibiscus syriacus*, is also recorded.

Bougainvillea glabra is a short-day plant. In Washington, it flowers during the short days of winter, and in May, when the days are long, flowering has ceased. Three plants were taken in May, and all pruned to a similar size. One plant was given 10 hours of light daily, one 12 hours and the other the normal daylight, which in June extends to 15 hours. The 10-hour plant flowered on July 9th, the 12-hour plant on August 4th, and the plant exposed to full daylight had not flowered at the beginning of October. This indicates that our Bougainvilleas might be even more floriferous if we could give them shorter days then they have in Malaya. But, as everybody knows, the flowering of Bougainvilleas is not only dependent on length of daylight; if it were, all our plants would all behave alike, which they are far from doing. However, there is scope for some interesting experiments on our local Bougainvillea plants. In the article quoted, only *Bougainvillea glabra* (the common purple Bougainvillea) is mentioned; probably other kinds will not all behave in the same way.

The other plant of local interest which was dealt with in the same series of experiments, *Hibiscus syriacus* (the " blue " Hibiscus), is somewhat troublesome to grow in Malaya. It is never very strong, and does not flower as freely as one would like. The experiments in Washington showed it to be a long-day plant. Plants were given the following periods of light daily: 10, 12, 12.5, 13, 13.5, 14 hours, and the normal daylight. Plants with only 10 hours light daily did not flower at all in four seasons. Plants with 12 hours had very few flowers. Plants with 12.5 hours (comparable to Malayan conditions) had a few more flowers, but it was only those with 13 hours or more which really attained a full flowering. This indicates

that perhaps we shall never manage to make this pretty Hibiscus a really suitable garden plant in Malaya. It is of course more suited to a cooler climate, but even the climate of our mountains will not make it flower its best.

In a recent issue of the *Botanical Gazette*, further experiments on the common orange Cosmos are reported. It is stated that plants may be grown to 15 feet high without flowering if they are given long days (14-15 hours light daily); on the other hand, they will grow and flower satisfactorily with as little as 7.5 hours light daily.

IMPRESSIONS OF A VISIT TO SINGAPORE BOTANIC GARDENS

BY

DR. G. A. C. HERKLOTS, HONG KONG.

I was fortunate enough to have the opportunity of spending the whole month of August in Malaya, the first fortnight and the last few days of which were spent in Singapore at the Botanic Gardens. The weather had been fine during the latter half of July and remained fine for the first ten days of August; in consequence flowering was exceptionally good. Some species were at their best at the beginning of the month, others only commenced flowering at the end, so a range of types was available for study.

First impressions of any place are usually few but vivid and mine were no exception. Beds of massed uniform colour and trees and climbers in full flower usually make a more immediate and lasting impression than mixed borders or shrubberies of species with different coloured flowers. A visitor therefore appreciates and remembers mass colour effects whereas a resident who lives in the garden and can study the plants in more detail very likely remembers individual plants and beds.

For vivid and impressive mass colour effects the following plants may be considered. Ixoras are not only easy to cultivate and are very floriferous but their compact heads of flowers are as useful for house decoration in appropriate bowls and vases as they are impressive in the garden bed or shrubbery. *Ixora macrothyrsa* with its scarlet-vermillion flowers undoubtedly takes pride of place but *I. chinensis*, *I. occulata*, both with red or orange flowers, and the yellow variety of *I. bandhuca* are also well worth growing. The bright crimson heads of *Pentas coccinea* (also Rubiaceae) make a fine show as the plant is free flowering and quick growing; moreover it is easy to propagate by cuttings of young wood. *Plumbago capensis*, which when in full flower may be completely covered with pale blue flowers, is perhaps best grown as a small shrub in a bed by itself. Pale blue can be fitted into almost any colour scheme without fear of colour clash, and beds of *Plumbago* look well against a background of rosy red double Oleander, —also a free-flowering plant which does best in a hot sunny and exposed situation. Hydrangeas also provide a wealth of blue blossom but these plants do best in situations where there is never any fear of water shortage. The blue colour of the flowers is much improved by applications of iron and potassium salts to the soil some weeks before the flowering period.

A variety of *Tecoma stans* has been introduced into the Gardens from Washington; it is very free flowering and has the advantage of flowering when quite small. A shrub some 3 to 6 feet in height may be kept almost continuously in blossom by judicious pruning. It sets seeds freely and seedlings reach the flowering state quickly. The flowers are yellow and

massed effects can be produced by close planting. The Allamandas are too well known to need more than mention; they are widely cultivated in Malaya both in the towns and in native kampongs.

Petrea volubilis is well known but is not, in my opinion, cultivated in Malaya to the extent that it should be. It may be grown as a shrub or as a climber but by reason of its somewhat open and straggling growth it is certainly happier and looks more effective as a climber. The petals are violet with a white spot on the lower petal, the sepals are pale mauve. *Petrea rugosa* is definitely a shrub. In this species the corolla and calyx are both deep mauve; I do not think it is as attractive as *P. volubilis*, but it is worth a place in the front of the shrubbery. *Congea velutina* is in the same family as *Petrea* (Verbenaceae) but here the colour effect is provided by the whorl of four bracts at the base of the group of small and insignificant flowers. These bracts are pink and being softly pubescent appear almost white at certain angles to the incident light. The general effect of a *Congea* in full flower is therefore striking, and the pink, being such an unusual flower colour, is not easily forgotten.

When planning a garden in which it is desired to mass colours, great care should be taken not to allow the clash of opposing dominant shades. In this connection Bougainvilleas, though extremely showy, must be used with discretion. About 25 varieties are now grown in Malaya and approximately 15 of these are in the Singapore Gardens. Unfortunately there is no reliable literature on the hybrids and varieties of this genus, many being known simply by fancy names which give no clue as to their relationships. Bougainvilleas planted indiscriminately will ruin a garden; the purple bracts of certain varieties are so aggressive that they will not allow other dominant shades, such as certain reds and oranges, in their neighbourhood without horrible offending clashes. For this reason it is best to see the variety in flower before you plant it in your garden and beware of the purple and purple-red varieties if you have a keen sense of colour value. The scarlet or scarlet-crimson *B. Mrs. Butt* is very showy and can be fitted in more easily than the purple varieties though the paler and very lovely *B. formosa* (of unknown origin) should certainly be grown. Almost any one variety of Bougainvillea looks well in association with the large white flowered Frangipanni with the dark obtuse leaves (*Plumeria alba* I believe is the species), but keep to one shade of red or purple.

Trees which provide a great wealth of glorious blossoms include the different species of *Saraca* of which perhaps *S. taipingensis* is the best known in Malaya. This species may bear large heads of orange-yellow flowers in such profusion that the trunk and branches are completely hidden. It is a species which, in the wild, certainly grows best in well watered places such as stream beds. No other tree, in my opinion, approaches these species for massive colour effects. Some of the Cassias deserve fuller appreciation e.g., *C. fistula* with pendulous racemes of yellow flowers, *C. multijuga* also with yellow flowers and the pink-flowered species *C. grandis*,

C. nodosa and *C. javanica*. Another showy tree is *Lagerstroemia flos-reginae* with its large pale purple or, in some varieties, pinkish flowers; this species is well worth cultivating when a mass of colour is desired.

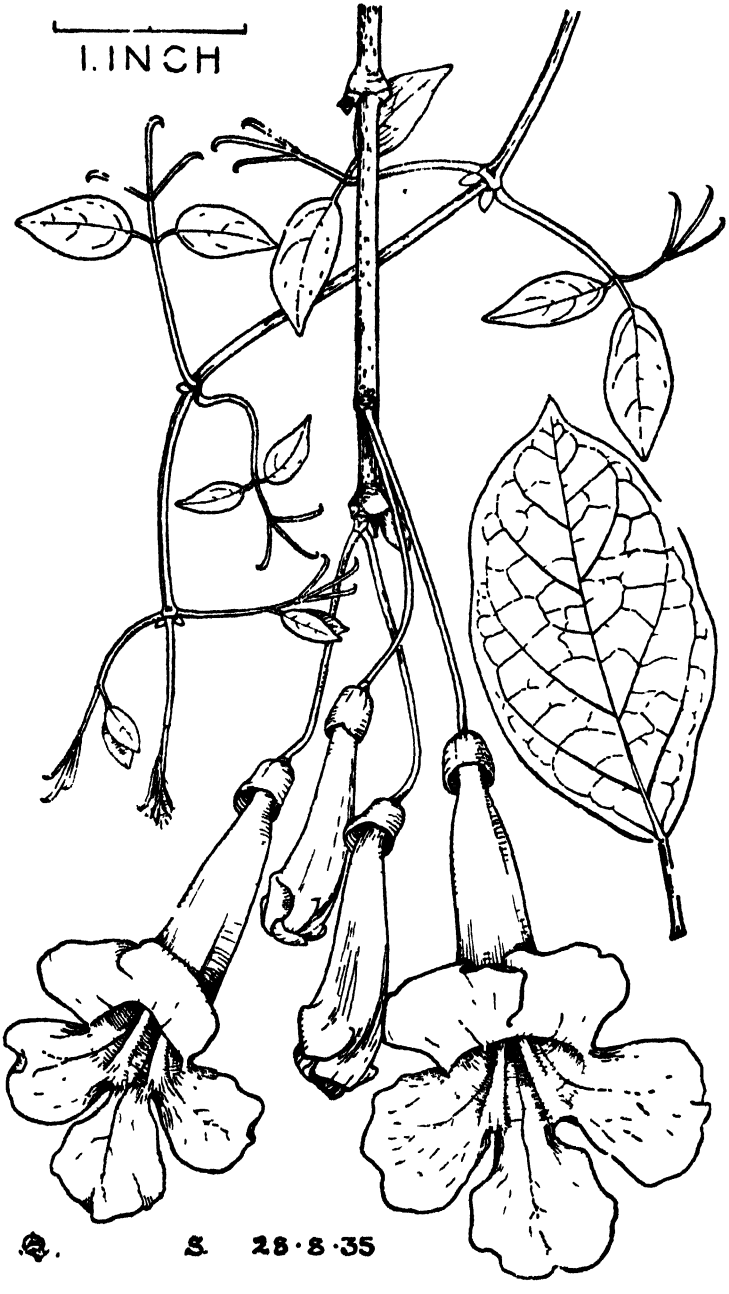
I am myself particularly keen on climbers, especially those belonging to the families Bignoniaceae, Apocynaceae and Asclepiadaceae, for the reason that if properly grown they provide a wealth of blossom in a comparatively small space. Climbers might be cultivated with advantage to a much greater extent in Malaya, as they can be used for a variety of purposes. Trained up a fence they will effectively screen an unsightly outhouse and they can also be used to clothe pergolas and arches. In the Singapore Gardens a great variety of climbers is cultivated but few of these are grown to any extent in the Peninsula. I recollect seeing *Tristellateia australasica* (Malpighiaceae) with clear yellow flowers growing on a fence next to pink Honolulu creeper at Pekan and the colour combination, though unusual, was definitely pleasing. On two occasions I noticed the white star-like flowers of *Rhaphistemma pulchella* and also on two occasions the fragrant blossoms of the Tonkin creeper *Pergularia odoratissima* (both Asclepiadaceae). *Quisqualis indica* (Combretaceae) known as Rangoon Creeper or Drunken sailor, with its fragrant flowers, opening white the first evening and changing in the course of two days to blood-red, is sparingly cultivated but might be more extensively grown. I believe that in the hills several Bignonias are grown but the only one I saw in flower in the lowlands outside the Gardens was *Arrabidaea magnifica* (previously known as *Bignonia magnifica*) with large violet-red flowers. For growing up high trees *Adenocalymna marginata* with very large yellow flowers three inches across might be given a trial or the better known *Bignonia unguis-cati*, also with large yellow flowers. For fences up to 9 feet in height *Bignonia Tweediana* (yellow), *B. aequinoctialis* (custard yellow), *B. incarnata* (light violet), *Pandorea jasminoides* (white with pink throat) and *Pandorea Ricasoliana* (pale pink), all members of the Bignoniaceae, are worth trial, but some do not flower well in the uniform climate of Singapore.

In Hong Kong the three most easily grown and floriferous climbers are *Thunbergia laurifolia* (Acanthaceae) (very pale mauve), *Pyrostegia* (*Bignonia*) *venusta* (Bignoniaceae) (rich orange) and *Clerodendron splendens* (Verbenaceae); the first of these certainly does well in Malaya, the second and third probably require a dry season for free flowering. *Pyrostegia venusta*, the Cracker Flower, is the climber which flowers so freely at Repulse Bay, Hong Kong, in December, January and February.

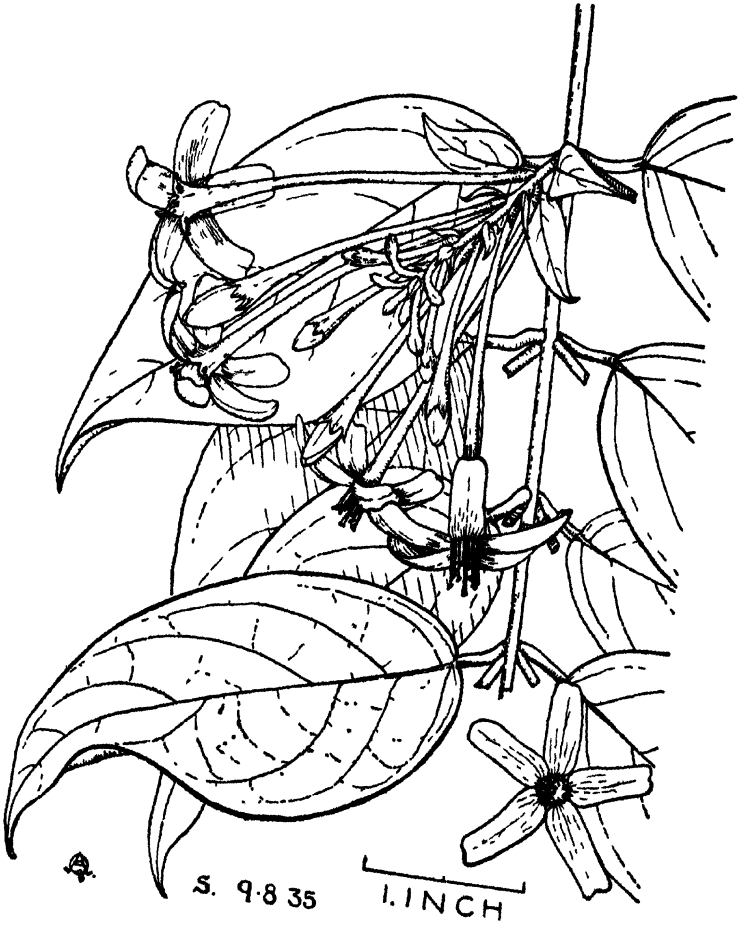
Many people who grow shrubs and climbers take a certain amount of trouble at the time of planting to ensure adequate drainage and good soil conditions. This is a good start, but it should not also mark the end of the attention to the plants. Climbers are greedy plants and if given good drainage repay regular manuring both with organic and chemical fertilisers, for humus decays rapidly in the tropics and salts tend to get washed out of the soil by the heavy rain. When planting a fence with

climbers, keep these points in mind and see that the plants are not starved. The increased growth and resultant increase in blossoms will well repay the extra trouble taken.

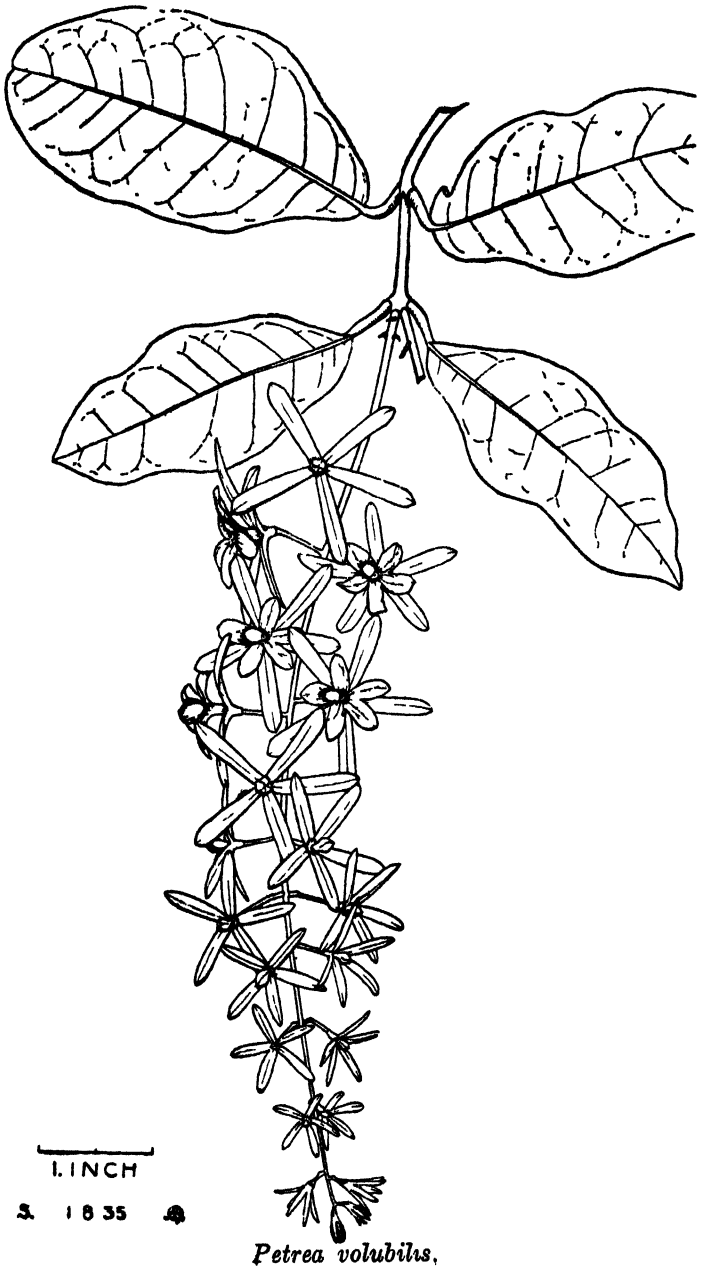
I have only mentioned briefly a few shrubs and climbers which are worth consideration; there are many more available at the Singapore Gardens, some of which can be grown easily from seed, e.g., the scarlet *Quamoclit phoenicea*, the scarlet or white Cypress Vine *Quamoclit pinnata*, the well known sweet-scented white Moon-flower, *Calonyction aculeatum* (*Ipomoea grandiflora* and *I. bona-nox*) and the annual Morning Glories, *Ipomoea purpurea*, *I. tricolor* and *I. hederacea* (all Convolvulaceae).



Bignonia Tweediana.



Quisqualis indica.



Petrea volubilis.

MALAYAN PLANTS FOR MALAYAN GARDENS *

BY

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When one looks over the list of the most commonly cultivated plants in Malayan gardens, one cannot fail to be impressed with the very high proportion which have been introduced from other countries. Whether trees, shrubs, climbers, annuals or pot plants, the majority are introduced. We have *Poinciana* from Madagascar, the African Tulip tree from West Africa, *Jacaranda* and the Rain Tree from South America, *Cassia fistula* from northern India, the Royal palm from Cuba, the Traveller's Palm from Madagascar, Bougainvilleas from South America, *Caesalpinia* from the West Indies, the common *Hibiscus* from China and its hybrids from Honolulu, *Petrea* from South America, *Odontadenia* from Trinidad, the common white *Clematis* from southern India, Allamandas from South America, Crotons, Acalyphas and "Dracaenas" from New Guinea and the Pacific, *Cosmos* and *Tithonia* from Mexico, *Coreopsis*, black-eyed Susans, and marigolds (African) from North America, Maidenhair ferns from the West Indies and the Andes, Anthuriums from Brazil, Junipers from China; these and many more are aliens to Malaya. One is quite justified in looking round and wondering where the contribution of Malaya to our gardens can be found.

My purpose is to mention some of the local plants which are commonly grown in gardens, with some remarks about their uses, and to mention also a number of others which are not yet in general cultivation, but which might very profitably be grown. Some of these latter could only be grown at hill stations, but by hybridisation they might give rise to offspring which would tolerate lowland conditions.

It is true to say that in temperate regions the very large majority of garden plants to-day are the result of a long process of breeding and selection, and that very few of them are the species as they are found wild in nature. In tropical gardens this process of breeding and selection has hardly begun (though some tropical plants have received attention in European hothouses), and as regards Malayan plants under local cultivation the only two instances I can recall are the orchids Vanda and Spathoglottis. Our pitcher plants, Cypripediums and two Rhododendrous have been used by breeders in Europe, but many other fine ornamental plants have never been brought into hothouse culture, partly owing to the difficulty of getting them to Europe alive, either as plants or seeds, and partly owing to difficulties of cultivation. The late Charles Curtis, of the Waterfall Garden, Penang, introduced some herbaceous Malayan plants to Europe, but their cultivation has not been generally pursued and they play no part in hothouse displays.

* Substance of a lecture delivered to the Selangor Gardening Society, October 1935.

Of ornamental plants from other parts of the tropics, the only ones commonly grown here which are the result of garden improvement are Cannas, the various races of Hibiscus from Honolulu, some of the Bougainvilleas, the hybrids of the Burmese Begonia Rex and of some south American Begonias, the various forms of Coleus, some Balsams, some Dracaenas, a few Ixoras, the Zephyranthes hybrids raised by Mr. Milsum, some maidenhair ferns which have hybridised or sported in European greenhouses, and of course the Cattleyas which have been one of the chief objects of the orchid breeder's art. There are endless opportunities for the improvement of other classes of tropical plants, and if we are to have resultant varieties which are really suited to the Malayan climate, we shall have to breed some of them in Malaya.

The Malayan flora is very rich, comprising in the Peninsula alone something like 7000 species; and Dr. Merrill estimates that in the region between here and New Guinea and the Philippines there must be about 45,000 species of higher plants. The natural vegetation of Malaya, in which this great variety of plant life is associated together, is high evergreen forest, the tall trees providing a canopy of shade and controlling the conditions under which the other plants exist Sun-loving shrubs and herbs such as we usually associate with gardens have no place in such a forest; they could at best only grow upon the edge of it. It is only when the forest is removed, by the action of man, or by a catastrophe such as a flood or a landslide, that sun-loving plants can find a place to grow. Such sun-loving plants form the scrub and *belukar* which are familiar near settlements in Malaya; they are mostly of widely distributed species, and it is curious that few of them are of any ornamental value. Among the exceptions to this rule are a few trees, including the beautiful pink-flowered *Cassia nodosa* which is so abundant in Pahang. Conditions change in the extreme north of the Peninsula, and there one finds much more persistent open vegetation with a number of ornamental plants. This condition is no doubt associated with the pronounced regular dry season; it is notable that most of the fine flowering trees and shrubs of the tropics are from strongly seasonal climates, and some of these plants do not flourish in the uniform climate of Malaya.

Apart from secondary growth, the only positions in the natural vegetation affording exposed situations comparable with those usually found in gardens, are riversides, the tops of forest trees (where are to be found climbers and epiphytes) and the exposed ridges and summits of mountains. There are also special situations such as sandy sea coasts, and the rock crevices in limestone cliffs, to which particular plants have become specialised. There is also the mangrove vegetation, which is not of much interest to gardeners, except for the orchids on the trees, and the yellow-flowered climber Tristellateia.

For the rest, the great bulk of the native plants of Malaya are shade-loving forest plants. Some of these will tolerate more or less open

conditions, but most require shade and a more or less humid atmosphere, to allow for which special provision has to be made in a garden. A garden, in fact, is a very unnatural thing in Malaya, quite different from the prevailing vegetation of the country, so it is perhaps not surprising that most of our garden plants are introduced from other countries with different climatic conditions. Of the shade-loving forest plants, a small proportion only are suitable for cultivation, even if the right conditions can be given, and of these the majority are unfortunately mountain plants which can only be grown with difficulty in the lowlands.

The remaining part of this paper is a summary of the various Malayan plants which are or might be of value in horticulture from a decorative standpoint, arranged under the headings of trees, shrubs etc. The list is not exhaustive, but it is hoped that nothing really important has been omitted.

Flowering Trees.

Under this heading are included trees which have specially beautiful flowers, though many of them are valuable for their foliage also. There is no sharp line of distinction between flowering and foliage trees, and some species (e.g. the Rain Tree) are on the border line between the two classes. Most of these trees are mentioned in Mr. Flippance's articles on Roadside and Avenue trees (see this Magazine Vol. V. Nos. 1 and 3).

Peltophorum ferrugineum (Leguminosae) Batai. A moderate-sized tree, distributed from Tenasserim to Australia, especially on sea coasts; the yellow flowers are borne freely about twice a year.

Pterocarpus indicus (Leguminosae) Angsana. Widely distributed from Tenasserim southwards and through the Malayan region eastwards, especially near the sea. A magnificent tall avenue tree, seasonally covered with a sheen of gold. In Singapore it has been seriously affected by a mysterious disease, which has killed most of the trees.

Cassia (Leguminosae). The only two native tree-species of Cassia are *C. siamea* and *C. nodosa*, both widely distributed in southern Asia, and both occurring as trees of secondary growth in Malaya. *C. siamea* is a rather tall straggly tree with yellow flowers which are produced throughout the year; it is evergreen. *C. nodosa* is deciduous, and has pink flowers with the young leaves. At its best it is very handsome, but in Singapore at least often does not flower well. There may be various races of this species. *C. javanica* is closely allied (see Mr. Corner's paper in this Magazine, Vol. V. No. 2).

Saraca (Leguminosae). There are eight species of this genus native in Malaya. They are mostly small to medium sized trees of forest, usually growing beside streams. All bear their orange flowers in large masses on the old wood. *S. taipingensis* (Tanglin) is the best for most purposes, but all are worth growing in suitable surroundings. They grow best with other trees, not singly in the open. Flowering is seasonal but occurs several times a year.

Erythrina (Leguminosae). Dadap. There appear to be two species of this large genus native in the north of the Peninsula: *E. indica* and *E. atrosanguinea*. Both are deciduous and flower when bare of leaves. They do well in the north, but in Singapore the dry seasons are not regular nor pronounced enough to induce them to flower really well. They are moderate-sized bushy trees of rapid growth, easily grown from cuttings. The flowers are scarlet.

Lagerstoemia flos-reginae (Lythraceae). Bungor. Distributed from Burma through the Malayan region. In Malaya, it is most conspicuous by rivers, but occurs as a large forest tree in Pahang. The flowers are typically mauve, but various pink races exist. It is a very beautiful tree, the only disadvantage (in the south at least) being its habit of often flowering on one branch at a time.

Lagerstroemia floribunda. A smaller tree than *L. flos-reginae*, with smaller flowers, native in the north; very attractive when in flower.

Mesua ferra (Guttiferae). Penaga; Ceylon Iron-wood. Widely distributed in the Indo-Malayan region; in the Peninsula a forest tree of second rank. A shapely tree with beautiful red young foliage and large white flowers.

Calophyllum inophyllum (Guttiferae). Penaga Laut. A seashore tree distributed from Africa to Polynesia. A bushy tree of moderate height, with handsome dark glossy foliage and abundant small white flowers, borne seasonally. It is most suited to sandy soil and exposed places.

Cratoxylon formosum (Hyperiacaceae). Mempat. Deciduous trees of secondary growth, flowering when bare after leaf-fall. The small pink flowers are rather like almond blossom. There are two varieties, one with larger and the other with smaller leaves; the young leaves of the latter are dark red while the pink flowers are open. *C. Maingayi*, common in Penang, is similar in growth, with white flowers.

Murraya exotica (Rutaceae). Kemuning. A small tree with small glossy foliage and fragrant white flowers, widely distributed from India to Australia; possibly native on limestone hills in the Peninsula, and much planted for its fine hard wood. A beautiful small garden tree, of slow growth.

Cyrtophyllum (or *Fagraea*) **fragrans.** (Loganiaceae). Tembusu. Distributed from Lower Burma southwards; in Malaya, a tree of secondary forest on clay or in swamps. Beautiful as a foliage tree, with abundant fragrant flowers seasonally; best on heavy or wet soils.

Eugenia (Myrtaceae). Jambu, Kelat, Kerian. A large genus with about 120 species in the Peninsula. A few are fruit trees. Several are of ornamental value. Those chiefly planted are: *E. grandis* (Jambu Ayer Laut), a seashore tree from Siam southwards, tall, with large glossy leaves and masses of small white flowers two or three times a year; *E. lineata*, a smaller shapely bushy tree with small leaves and smaller heads of white flowers.

Dolichandrone Rheedii *(Bignoniaceae).* Kulo. *Distributed from India to New Guinea, chiefly near the sea; the only local tree of the family* which is used ornamentally. It has attractive large white flowers, which open at night. It is more often seen planted in the north, but there are trees in Johore Bahru.

Barringtonia speciosa (Myrtaceae). Putat Laut. A tree of sandy seashore, widely distributed in the Indo Malayan region; bushy, of moderate size, with handsome large foliage and very large white flowers which open at night. Some other species of Barringtonia are also sometimes planted; most appear to be night-flowering.

Randia exaltata (Rubiaceae). A moderate sized tree of forests in Penang, very handsome seasonally when covered with white flowers. The other local species are not specially showy; *R. macrantha*, often planted in gardens, comes from West Africa.

Elaeocarpus (Tiliaceae). Dĕrumun. Moderate-sized trees, mostly of secondary growth; a few are attractive when in flower. The flowers are mostly white, and produced seasonally in large numbers. *E. sahcifolium*, with small foliage, is particularly attractive.

Dillenia and **Wormia** (Dilleniaceae). Simpoh. Several species of these two genera are very handsome when in flower, but they do not seem to flower often enough to be worth planting in gardens, except the common *Wormia subsessilis*, a small bushy tree of attractive large foliage and yellow flowers produced throughout the year.

Erythropsis fulgens (Sterculiaceae). A moderate sized tree native in the northern part of the Peninsula. It is deciduous and flowers when bare of leaves; the flowers are deep orange in colour. It needs a good dry season to flower well.

Anonaceae. In this family are a large number of local trees which have attractive and often fragrant flowers. They are rarely showy, but some are worth growing for the interest and fragrance of the flowers.

Foliage Trees.

Adenanthera pavonina (Leguminosae). Saga. Widely distributed in S. E. Asia. A moderate-sized bushy tree with dark foliage of the feathery type, quick in growth; deciduous, bearing small Mimosa-like flowers with the new leaves, and twisted black pods containing bright red seeds.

Parkia Roxburghii (Leguminosae). Kĕdawang. A very tall tree, only for large gardens, with a high spreading crown of deciduous feathery leaves. Unlike Albizzia, which has a similar habit, Parkia is hard-wooded and durable, and when well-grown is a most stately tree. It should be more frequently planted in suitable places.

Terminalia catappa (Combretaceae). Kĕtapang. A sea-shore tree of wide distribution; tall, with spaced groups of wide-spreading branches, and large deciduous leaves. Especially suitable for sandy shores but will grow in any well-drained place; a very handsome and shapely tree if properly handled.

Cinnamomum iners (Lauraceae). Kayu manis; wild Cinnamon. A small bushy tree widely distributed in the Malayan region; very useful for screening purposes, with beautiful red young foliage.

Baeckia frutescens (Myrtaceae). Chuchor atap. A small tree of weeping habit with very fine needle-leaves and small white flowers; in Malaya on high mountain ridges and on sandy soil in the lowlands of Lower Siam. A very attractive tree where it can be got to grow.

Engelhardtia nudiflora (Juglandaceae). A small-leaved tree of the walnut family, the delicate young foliage a most beautiful pink.

Ficus benjamina (Moraceae). Waringin. This is the commonest of a large group of wild figs, of which the Indian Banian is the best known. They usually start their growth in the branches of other trees and put down long aerial roots. When these reach the ground, the tree begins to grow rapidly, and in time strangles its host. Trees of this type may be planted in the earth in the ordinary way, but they usually make finer trees when they start some distance above the ground. The Waringin is small-leaved, spreading, with graceful drooping branches. Other species are taller, and have larger leaves. The roots of all are very wide-spreading, and are apt to be troublesome in a garden.

Casuarina equisetifolia. Ru; Chemara. This tall and graceful tree of sandy sea coasts is too well known to need description. It is widely distributed from Malaya eastwards to the Pacific. See this Magazine, Volume 3 No. 3.

Dacrydium elatum (Taxaceae). Ru Bukit. A coniferous tree, native in mountain forests of the Peninsula and distributed through the Malayan region to Queensland. It is a shapely tree of graceful foliage, and has been largely planted on Penang Hill. Dacrydium and Podocarpus (see below) are southern genera, little represented in the northern hemisphere beyond the tropics; like other members of the Yew family, they have single seeds, not cones. See this Magazine, Vol. 4 No. 4.

Podocarpus polystachyus. (Taxaceae). Sintada. A small seashore tree, not so shapely as Dacrydium and with much larger leaves. Well grown trees are very decorative, and a belt of them would make a fine screen, though slow-growing.

Podocarpus imbricatus. A larger tree, resembling Dacrydium in habit, but with different foliage. It is widely distributed in the Malayan region in mountain forests but also grows quite well in Singapore, making larger and finer trees than Dacrydium.

In the forests of Malaya are over 2,000 species of trees, mostly evergreen, and mostly with not very conspicuous flowers. Many of them might be grown for ornamental purposes as screening or shade trees, but to deal with them in a short review such as the present is impossible.

Ornamental Fruiting Trees.

A few kinds of trees have very decorative fruits, though their flowers

and foliage are not specially remarkable. The most striking of these in Malaya are the various species of *Sterculia*, of which several are occasionally planted. They are distinguished by fruits of the most brilliant red that one can imagine; when the fruits open they display glistening black seeds.

Various other forests trees have ornamental fruits, notably some species of *Dysoxylum* (Meliaceae).

Palms, Pandans, and Cycads.

There are many Malayan native palms, but only a small proportion are in general cultivation. Many of the local palms are climbing rattans, very thorny and when full grown not at all suitable subjects for the garden; yet in their early stages they are often very decorative and some of them can be kept as practicable clumps.

Cyrtostachys lakka. Pinang Rajah; Sealing-wax palm. This is a native palm of freshwater swamp forest, occurring in Malaya, Sumatra and Borneo. As an ornamental garden plant it is the finest of local palms and perhaps of all palms in existence. The plants grow well in heavy soil.

Oncosperma. Nibong and Bayas. These two palms form very tall groups, and for a large garden are very fine. They prefer wet or heavy soil.

Areca catechu. Pinang; Betel-nut. These palms are often planted ornamentally as well as for use. Their erect green stems are decorative.

Arenga Westerhoutii. Langkap. This is a forest palm, growing in tufts, allied to the common Kabong or sugar palm, but smaller, and more suitable for garden planting. It makes very bold clumps, but when old may become rather untidy.

Caryota mitis. These palms with their twice-branched leaves are very decorative for screening thickets, but need the old stems cutting out from time to time.

Several other smaller palms of the shady forest are suitable subjects for cultivation, especially in shady parts of the garden; some will stand a moderate amount of sun on their crowns if their roots are protected.

Pandans. About 30 species of Pandanus occur wild in the Peninsula. Their curious formal habit limits their garden use but some of the larger kinds are very handsome where there is room for them. Their conical groups of stilt-roots are characteristic.

Cycads. These are small palm-like plants which bear cones. They are not palms, but belong to a primitive group now nearly extinct. In the Peninsula are two native species: *Cycas Rumphii*, fairly common near the coast in many places, and *C. siamensis*, found on the limestone in the north. The latter is the more compact and decorative species for garden use.

(To be continued)

AVENUE TREES (*Continued*)

BY

F. FLIPPANCE, F.R.H.S.

Assistant Curator, Botanic Gardens, Penang.

Before continuing with the discussion of the various species it is felt that emphasis should be laid on the fact that having dealt with the better known trees under the earlier "Roadside Tree" papers, the trees mentioned under "Avenue Trees" will contain many species which are less widely known. In addition, it must be emphasised that practically all the species dealt with under "Roadside Trees" are also suitable for avenue work. However, as these were dealt with at some length under the previous papers it would be redundant to deal with them in full under the heading of "Avenue Trees." It is proposed to give a complete list of trees suitable for Avenue work together with relevant notes at the end of these articles.

Michelia longifolia.

In Malaya there are two Champakas which are commonly cultivated viz:—

Bunga Chempaka (*Michelia Champaca*) and Bunga Chempaka Puteh (*Michelia longifolia*). The former is an Indian species and the latter a Javanese species. The latter is the subject of this paragraph. The Champacas belong to the Family *Magnoliaceae* and an examination of the flowers will show the likeness to the Magnolias of temperate climates. However, from a flowering point of view, there is no comparison as the flowers of the tropical species are somewhat inconspicuous. But this lack of effectiveness in the flowers, is to some extent recompensed by their peculiarly pungent scent, which has its own special attraction, particularly for people of this part of the world. *Michelia longifolia* is a rather handsome tree when well grown. It produces a bushy type of tree in which two or three or more leaders grow up, at more or less equal heights, to produce a heavy bushy crown. For avenue purposes, it is a good subject from the point of view of heavy foliage and an excellent subject if planted where its pungent scent is likely to be appreciated. As has been stated, its flowers are rather inconspicuous and therefore, it would be better if planted in association with a species which would produce plenty of colour, such as *Cassia fistula* (Indian Laburnam). The combination of scent and colour would be particularly effective. It is a quick grower when once established and will stand heavy pruning. It requires a fair amount of space to attain its best proportions on account of its slightly spreading habit. Suitable distances would be 50 feet between the trees and not less than 20 feet from the road. An effective method of planting would be to have two rows of trees on each side of the road, the rear row *Michelia longifolia* and the front row *Cassia fistula*. The latter species grows to about half the height

of the former, and would show up extremely well against such a background.

The remaining large trees of value for Avenue purposes are of the type which grow to very tall trees and in so doing produce attractive trunks with a crown of foliage at the top which may be either spreading or more or less compact. Such trees could only be used in the layout of large areas which usualy demand the use of large trees e.g. in the layout of parks, etc.

Parkia spp.

Under this heading come the two Malayan trees *Parkia speciosa* (Petai) and *Parkia Roxburghii* (Kedawang). In appearance they are very alike and the chief botanical differences seem to lie in their respective fruits. However, there appears to be a difference in habit as *P. speciosa* branches much lower than *P. Roxburghii* and is in consequence somewhat more spreading, and if anything, the latter species is taller. Fine specimens of these species are magnificent trees. The trunk is large and slightly buttressed at the base. Its roots are prominent for a small area around the base of tree, the buttresses merging into them. A good specimen has a circumference of 11 to 12 feet at about 6 feet from the ground and is 70 feet and upwards in height. The trunk is of a light colour and has fairly smooth bark. The spreading crown of foliage is most attractive, being made up of finely divided or pinnate leaves. The whitish flowers are produced in pendent spikes on which they are closely clustered at the ends. Some of these spikes produce fruits of the typical leguminous type but many do not and remain for a short time on the tree, giving it the appearance of bearing a large crop of drumsticks. This type of tree requires plenty of room for its crown to develop and this gives room below for interplanting with a smaller and more compact type of tree. It gives opportunity for the development of a double avenue and such obviously can only be developed in large areas. Planting distances should be not less than 80 feet and 25 feet from the road, the latter should be increased if it is proposed to plant a smaller species below. The spread of a good specimen is 80 to 100 feet, so alongside a 40 feet road and planted at 25 feet from the road, the branches will meet and form what is termed a pleached avenue. Such an avenue is attractive both from the road level and at a distance.

Pentaclethra filamentosa.

Another species of a somewhat similar type is *Pentaclethra filamentosa* a West Indian species. However, only one large specimen has been noted and that is in the Botanic Gardens, Singapore. Its flowers are an attractive feature being borne in dense spikes, they are whitish in colour and are marked with dark spots or blobs. Its foliage is similar to *Parkia* and its habit is much the same. It is a species which should be more widely known. Unfortunately it does not produce seeds in Singapore.

Another species of a somewhat similar habit is *Albizzia moluccana*. However, this is *not* recommended for avenue work, as owing to its rapid

growth its wood is rather soft and it is therefore an easy prey for white ants and large branches are liable to split off. In addition, it is a surface rooting type and is liable to be blown over in high winds. This does not apply to the *Parkia* spp. or *Pentaclethra filamentosa* as their wood is much harder and their rooting system is a much deeper and stronger one.

It may be mentioned that *Parkia* spp., *Pentaclethra filamentosa* and *Albizzia moluccana*, are all members of the Family *Leguminosae*.

Sterculia macrophylla.

Some of the Sterculias (Family *Sterculiaceae*) are very attractive trees but generally speaking they are not very widely known. The species which is most attractive from a horticultural point of view is *Sterculia macrophylla* (Malay name—Milian). There is an excellent specimen in the Waterfall Gardens, Penang, which shows the characteristic buttressed trunk. This specimen is not by any means a large one and should grow to very much larger proportions if it is not damaged or attacked by white ants. Its whorled manner of growth is attractive its branches being sent out at definite points on the trunk, rather in umbrella fashion and being succeeded by another whorl higher up and so on. Its flowers are inconspicuous but are succeeded by bunches of velvety, flame-coloured fruits which split open and disclose the black seeds. At this stage a tree is a most attractive sight. This combination of buttressed trunk and brilliantly coloured fruits should obtain for it a much wider use. In the open it bears its first whorl of branches about 30 feet from the ground. These do not spread very much, and succeeding whorls are generally slightly shorter. The tree grows upwards rather than outwards. Its leaves are large and at leaf-fall they are shed completely and in a very short time. Thus, the tree is a clean one from this point of view. For avenue purposes it should prove an attractive tree especially if used with a shorter growing species in front of it. Planting distances should be about 60 feet between the plants and not less than 20 feet from the road.

Ailanthus malabarica.

This Indian species is of a somewhat similar type to the foregoing though it belongs to a different family viz. *Simarubaceae*. It grows to a good height, has a light coloured straight trunk, and bears pinnate leaves. Its attraction, from a colour point of view, is the production of bunches of winged fruits which are of a bright salmon colour. When in fruit it is a particularly striking tree. It is not recommended that it be used alone but rather that it be mixed with a *Sterculia macrophylla* avenue, to which its habit of growth and size lends itself. Planting distances should be the same as that suggested for *Sterculia macrophylla*.

Schima Noronhae (Kĕlat Gĕlugor.)

This species is mentioned as it appears to be a very suitable type for use at an elevation of from 1,000 to 2,000 feet above sea level. In Malaya it is a common jungle tree at that elevation and where it occurs

in quantity, as it does on the slopes of the Penang hills, it produces a beautiful effect both at the period of new growth, when the young foliage is reddish brown and at its flowering period, when it produces large white flowers which have something of the appearance of white wild roses. It belongs to the Family *Ternstroemiaceae,* and is a relative of the *Camellia* and of course of the Tea plant (*Camellia Theifera*). There are one or two good specimens in the Waterfall Gardens, Penang, but at this elevation (about 50 feet above sea level) it does not produce the beautiful effect obtained higher up. It grows to a tree of about 50 feet and upwards in height, and produces a sturdy trunk which is clothed with a rough fissured bark. The leaves are on the small side, are dark green and leathery in texture. It produces a fairly compact head of foliage which is not of large dimension. For planting along an ascending road or avenue it should be very effective, especially when viewed from above at the period of new growth. Planting distances should be about 50 feet between the plants and not less than 20 feet from the road.

(To be continued)

THE HYBRIDISATION OF CANNAS

BY

J. L. PESTANA,

Botanic Gardens, Singapore.

Is the reader aware that practically the whole face of the flowering-plant world can be changed if only one knows how to do it ? It can be done, at least in one way, and that by means of hybridisation. By skilful hybridisation, it is almost possible to produce in a hybrid flower any desired colours, and any shape, size or habit, according to one's whims or fancies. This kind of hybridisation, being done by man, is said to be done artificially because such is not effected by the ordinary forces of nature. On this subject of ' artificial ' hybridisation, its uses and benefits, many volumes have been written; these can be consulted by those interested, who wish to dive deep into the subject. The benefits scientific, economic or even cultural derivable from such hybridisation are infinite and well worth studying.

The practice of hybridisation is by no means a matter of insuperable difficulty, at least, in so far as it concerns the hybridisation of the Canna plant, which is the subject of this contribution by the writer, who as a producer of hybrids of this plant gladly recounts his experiences as he endeavours to impart whatever knowledge he has on the subject.

A few years ago I had the gratification of producing a few hybrid cannas following a series of failures embracing a period of more than three months. Many and diverse were the methods I adopted as I had no previous experience of hybridisation. All I knew was the principle of transferring pollen from one flower on to the stigma of a flower of an entirely different colour or type. With this knowledge I went on blundering along until I struck the right path. In this article I will show the method by which I brought about the hybridisation of cannas.

To have some idea of what I am writing about it would be necessary for the novice at the outset to have a preliminary knowledge of the different structural parts of the canna flower. For this purpose I have made a few drawings to illustrate and make more intelligible to the reader the different parts of the flower. In most flowers the conspicuous coloured parts are the petals, but in Cannas the petals are quite small, the showy parts being modified stamens; as they have the form of petals they are technically called petaloid stamens. Only one of these is fertile, i.e. it has an anther containing pollen.

In the process of pollination or rather cross-pollination, which means the transference of pollen from one flower on to another, we are concerned with only two essential parts of the flower. They are the pistil and the stamen, which are respectively the female and male parts of the flower. The pistil consists of an ovary containing ovules, a long style and a stigma at the end of it; and the fertile stamen consists of a flat filament, with

an anther containing pollen near the end and on one side of it. Pollination consists of the transference of pollen from the anther to the stigma. When the pollen is deposited on the stigma, fertilisation takes place. The pollen grain sends a tube down the style into the ovary where it fertilises the egg-cell in the ovule, which then grows into the embryo plant. The ovules then become the seeds and the ovary the fruit.

I do not know whether the reader has looked at a canna flower closely but if he has he will have noticed that in the open flower there is very little or no pollen in the anther. But if he opens a well-grown canna bud he will find that the anther has already shed its pollen, and has already deposited some of it on the style a little way below the stigma. The would-be hybridist should find out the peculiar habit of the flower he is working on before he can start any operations.

The actual cross-pollination of the canna is a simple process. First, select a well-developed bud of a plant to be used as female parent, one that would most likely open the next day. The stigma of this bud is to receive the pollen from the male parent. The selection made, the next thing to do is to unfurl the petaloid stamens with the tips of one's fingers, taking care that one does not injure the style in doing so. After that, clip off with a pair of scissors the anther from the stamen, and remove it from the flower. Then remove with a clean and soft piece of cloth the pollen adhering to the style, working with a downward motion all the time. This would minimize the danger of pollen reaching the stigma, for if it does so, self-pollination is bound to take place, resulting in what we wish to avoid. To make sure that no pollen has reached the stigma, examine it carefully with a hand lens. If any pollen is present on the stigma, the bud should be discarded and another one selected. Remember that a single pollen grain is sufficient to cause reproduction. After all these operations have been performed, take a bud from a plant selected as male parent, unfurl its petaloid stamens till the fertile one is seen, and with the scissors nip off the anther from it. With the anther containing the fresh pollen gently brush the stigma of the flower of the female parent, and leave on it a light layer of pollen. Then close up the bud carefully again, taking care not to leave the style exposed, as unnecessary exposure to the sun might have unfavourable results. After this, mark the bud with a piece of string, or some other device, to enable one to lay one's hand without difficulty on the flower or flowers in cross-pollination.

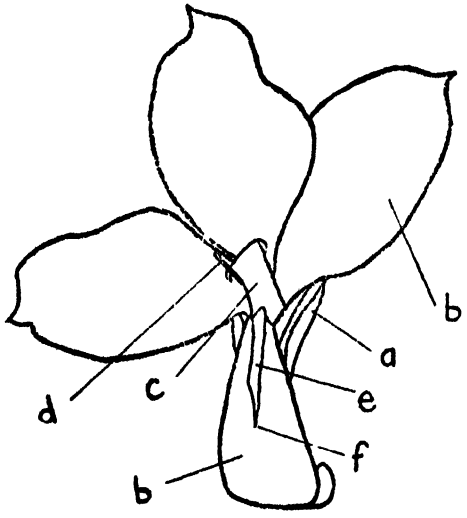
A few hints on the selection of cannas for hybridisation might not be out of place here. As far as possible select as female parent only plants which flower and produce seeds abundantly. If possible select as parents those plants whose flowers are large and showy, floriferous and of clean and pleasing habit, so that some or all these characters might be transmitted to the progeny. But if there should be a canna plant with small flowers having a rare and striking colour one should select it without hesitation. It has been observed that the hybrid is very seldom smaller than either

of its parents. Very often it is as big as or even bigger than the flower of the bigger parent. Flowers that are very mottled should not be selected as these might be further accentuated in the progeny, unless one's tastes are inclined in that direction, in which case there is no reason why such should not be selected.

After the flower or flowers have been cross-pollinated one would expect to see certain developments. In a couple of days one will notice that the flower will have fallen off, only the calyx and the ovary remaining. A few days later if the ovary is still a fresh green colour and shows signs of development one can almost be certain that fertilisation has been effected. But sometimes it may happen that the fruit develops but does not produce any seed. This may be due to some obscure reason or another, the explanation of which entails discussion of a much too technical nature. However, one who meets with failure the first time should try again. Should one fail again, then one must conclude that the male parent selected is unsuitable, and another one should be sought. This points to the desirability of trying not only one cross at a time but several in order to get variety and possibly discover what types of cannas make suitable parents.

Normally it takes about 42 days for a seed to ripen and be ready for sowing from the time of pollination. A canna plant will flower from seed within eight months from the time of sowing. Much depends on the time the seed takes to germinate. Some seeds take as long as two months to germinate or even longer. It is said that if seeds are immersed in boiling water for a few seconds and then lifted out and dried they take a very short time germinate. There are some people who recommend the filing down of the hard seed-coat about the region of the micropyle to facilitate the quicker throwing out of the radicle (root in the embryonic stage), and thereby bring about quicker germination. Either method may be tried, but I would advise the would-be hybridist to try the old-fashioned method when he deals with his own prospective and perhaps priceless hybrid seeds.

The writer would be glad to exchange Canna plants with a view to further hybridisation, and to demonstrate the method described in this article to any interested person who could call at the Botanic Gardens, Singapore.



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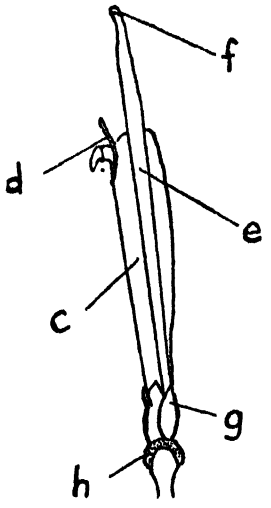

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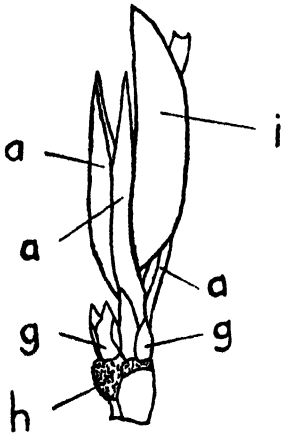

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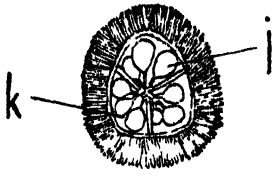

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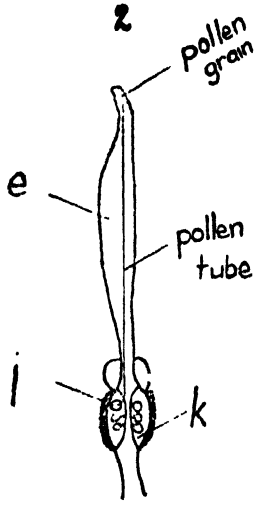

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1, Canna flower. 2, Canna flower with petaloid stamens removed. 3, Flower bud at right stage for pollination. 4, Transverse section of ovary, showing the three cells, each containing ovules. 5, Diagramatic section through style and ovary, showing course of pollen tube.

a, the petal. b, the petaloid stamen, which is sterile. c, the fertile stamen. d, the anther. e, the style. f, the stigma. g, the sepal. h, the ovary. i, the flower bud, right stage for pollination. j, the ovule. k, a cell of the ovary.

Review*

A DICTIONARY OF THE ECONOMIC PRODUCTS OF THE MALAY PENINSULA.

By I. H. Burkill, M.A., F.L.S., with contributions by W. Birtwistle, F. W. Foxworthy, Ph.D., J. B. Scrivenor, I.S.O., M.A., and J. G. Watson,

Published on behalf of the Governments of the Straits Settlements and Federated Malay States, by the Crown Agents for the Colonies, 1935. Two volumes, price 30s. [Local price $13.00]

This book is the result of ten years of continuous work by Mr. Burkill since his retirement from the post of Director of Gardens in 1925. The first three years were occupied with the compilation of information from published literature; this information, and the records of his own observations during his service in Malaya, was entered on 36,000 index slips. The work of writing then commenced, in collaboration with officers of the research departments in Malaya. That it has been an exceedingly laborious undertaking may be judged from the above remarks, and from the fact that the two volumes together contain 2,100 pages, the last 96 consisting of an index in double column containing considerably more than 10,000 references.

The author explains that this is a dictionary of economic products, not commercial products; that is, he includes everything, having a use of any kind, which can be grown or produced in Malaya, irrespective of its immediate commercial importance. The scope is similar to that of Sir George Watt's "Dictionary of the Economic Products of India," which was published in 1889-1893, and is still a mine of valuable information.

Mr. Burkill's work does for Malaya what Sir George Watt's did for India; it summarises information which has been recorded in a vast and scattered literature, published in many countries, and includes also unpublished records. Much of the information has hitherto only been conveniently accessible in a Dutch work on the useful plants of the Netherlands Indies. Mr. Burkill quotes in the text the sources of his information, so that any interested person can obtain fuller details by referring to the original sources.

As an example of the arrangement of the material, we may take the article on Acacia, which occupies 12 pages. First there is a summary of general information about the whole group, and then details about the various species which occur or have been tried locally. There are brief marginal headings to all paragraphs, which rapidly guide the reader in his search. The paragraphs on the genus Acacia have marginal headings as follows:

Woody plants with various uses; many of considerable value. But few tolerate the Malayan climate. Delayed germination. Timber.

* Reprinted from *The Straits Times*, Singapore, 27th November, 1935.

Many yield fuel. Bark tans. Resin. Gums very important. Uses of gum. A dye from one species. Saponins. Small medicinal uses. Perfume.

Then follow accounts of 10 species and their particular uses, with notes on the success with which they have been grown in Malaya and adjacent countries, again with marginal headings. The system of marginal annotation allows any particular item of information to be found with a minimum of expenditure of time, the paragraphs not relevant to the enquiry being rapidly ignored. Under every main heading is historical information of great interest about the early introduction or cultivation of the plants concerned.

The dictionary is arranged in alphabetical order under the botanical names of plants, with domestic animals under their common English names and minerals under their technical names. This is the only practicable arrangement, as local and popular names for plants are often uncertain in their application and sometimes lacking.

To facilitate reference in cases where only local names are known to enquirers, there is a very comprehensive index. Thus, if information about Jelutong is required, the index directs one to the heading *Dyera*, which is the botanical name of the tree. Under this head are listed Malay and other vernacular names, and a full account is given of the occurrence and products of the tree, the latter in this case written by Mr. J. G. Watson, Deputy Director of Forestry.

The index incidentally includes a very important and full list of Malay plant names, which have all been critically examined and many corrected of previous errors.

Information about plants and their products accounts for over 90 per cent. of the Dictionary. Of this, a considerable part is concerned with timbers and other forest products (e.g. rattans), the more important of which are dealt with in articles by Dr. Foxworthy and Mr. Watson. The remaining articles on plant products (by far the greater proportion) are by Mr. Burkill. For articles on agricultural plants he has had the co-operation of Mr. B. Bunting of the Department of Agriculture.

Mr. W. Birtwistle contributes short articles on all local fish; these are listed under their scientific names, with Malay names entered in the index. In writing the articles on birds, mammals and other animals, Mr. Burkill had the assistance of Mr. F. N. Chasen and Mr. M. F. W. Tweedie of the Raffles Museum.

Mr. J. B. Scrivenor, formerly Director of the Geological Survey, F.M.S., contributes all articles about minerals. Tin ore is dealt with under the heading Cassiterite. There are articles on gold, lead and other metals, granite, marble and other building stones, their occurrence and uses.

To the casual reader the book is full of unusual and interesting facts, and to dip into it is to become fascinated with the human side of the picture: how man has taken to his use the amazingly varied products of nature in the tropics.

The historical notes in the articles on cinnamon and other spices trace their story from ancient times. In the case of pineapples, chillies, papaya, chiku, and other plants, we learn how the Spaniards and Portuguese brought them from America to their various eastern settlements; the first chilli seeds were even brought to Europe by Columbus. The articles on Cinchona and Hevea tell the story of the introduction of other extremely valuable tropical American plants in more recent times. The introduction of plants from various parts of Asia by immigrant races can be traced.

The varied uses of a large number of native plants by the Malays are briefly recorded; many of these, together with the records of local names, take one into the realms of ethnology and linguistics, of mythology and magic.

Mr. Burkill brought to his task a very wide knowledge of economic plants, acquired during eleven years as reporter on economic products to the Government of India, and later thirteen years as Director of Gardens, Straits Settlements. During the latter period he added an intimate acquaintance with local plants and local conditions; he also collated much valuable information which had been accumulated by trials of introduced plants at the Botanic Gardens at Singapore and Penang. He brought also a patient application to his task, and a wide scholarship, all of which have combined to make this as complete a work as any single man could make it.

There are doubtless a certain number of inaccuracies and omissions; no book of this scope could be without them; but these are trivial as compared with the vast bulk of valuable material which is here collected for the first time between the covers of a single work.

It is the first really comprehensive Malayan reference book which has been published. It covers so wide a field that it contains something of interest for everybody. It should be in every business and government office; the more it is consulted, the greater its value will be found to be. At the price of thirty shillings it is extremely cheap, and it is to be hoped that the Malayan public will realise the value of the work which their Governments have with foresight sponsored; that they will buy and use it as it deserves to be used.

It remains to add that the printing has been done by the Oxford University Press. The high standard of typography and arrangement of the text add greatly to the appearance of the book, to its legibility, and to facility of reference. The only criticism on this score it that the volumes are rather heavy; three volumes instead of two would have been more convenient, but this would doubtless have involved additional expense.

R. E. H.

Miscellaneous.

CONTRIBUTIONS OF BOTANY TO TROPICAL AGRICULTURE *

Among the sciences that contribute to agricultural and horticultural progress, none has closer or more multifarious contacts with practical crop production than botany. If such contacts are apparent only to those most intimately concerned with agricultural research, the reason is to be sought in the comparative neglect of botany in the general educational system, which leaves the average layman under the impression that its main function is to give plants long names.

The science of knowing plants has inevitably been connected from the earliest times with the art of growing them. Its development can in fact be traced from the " physic gardens " of the Middle Ages, which served both medicine and horticulture, to the botanic gardens of later times with a distinguished record of services in the collection, identification and dissemination of useful plants all over the world (1). The latter perhaps reached the zenith of their importance in the Tropics during the nineteenth century, with the establishment of tea in India, cinchona in Java, and rubber in Ceylon and Malaya. Some remain, and to-day discharge wider functions than ever. Others have disappeared or lost their identity in agricultural departments. But the closing years of the nineteenth century and the early years of the twentieth saw the rise of tributary activities which have continuously broadened the course of botanical investigation ever since.

It was during this period that a growing realization of the enormous losses occasioned by insect pests and plant diseases called new specialists to the assistance of agriculture, on the one hand entomologists and on the other botanists who had devoted particular study to the group of plants called fungi. The entomologists and mycologists speedily justified their election and made great advances in the study of their problems. The demand for their services increased, and special courses of training were instituted in certain cases to meet the need. Reciprocally as the number of workers grew, investigations were pushed deeper, and it became increasingly evident that the study of host plant was not the least important part of the campaign. These successes had both a general and a particular effect on the position of botany in agriculture. They stimulated a general interest in the potentialities of applied research, and they revealed a need for the co-operation of botanists who had specialised along rather different lines.

Particularly, perhaps was the latter the case when the most promising possibilities of disease or pest control were found to lie in the substitution of resistant varieties of crop plants for susceptible varieties formerly grown,

* By E. E. Cheesman, *Tropical Agriculture*, August, 1935.

(1) This has been admirably done by Sir David Prain in a Sir George Birdwood Memorial Lecture delivered before the Royal Society of Arts in 1925, under the title of " Government Botanic Gardens." (*J. Roy. Soc. Arts, 73 (1924-25) 271*).

and extensive operations in plant breeding became involved. By a fortunate coincidence the rediscovery of Mendel's laws of heredity occurred during the same period of development, the basis of plant breeding was at last made sound and clear, and fresh emphasis was thrown on the constitution of the individual plant as a factor in agricultural success.

The position which botany has reached in the post-war development of agricultural research services is superficially obscured by a multiplicity of specialist labels. Problems are becoming more and more complex as knowledge advances, and demanding progressively more technical skill in diverse directions, which can only be obtained by increasing specialisation. Hence we find on the staffs of agricultural departments and research institutions officers described as plant physiologists, geneticists, plant breeders or cytologists, as well as economic botanists, systematic botanists, ecological botanists, and occasionally just simply botanists. A few of these labels may be useful to distinguish the main branches of a very big subject, but they tend to conceal three important facts, the first that all these specialists have a similar fundamental training, the second that it is rarely either possible or desirable for a botanist to restrict himself to one aspect of his science, and the third that in the end it must always be within a framework of general botanical principles that the contributions of specialists are fitted together for translation into improved agricultural practice.

A similar tendency is responsible for the use of labels such as " economic " to distinguish botanists who are working on agricultural, horticultural or technological problems from those who are not. This leads in turn to a distinction being sometimes drawn between " pure " and " applied or " economic " botany, whereas in point of fact there is no such division in the science. Considerable difference in outlook is inevitable between the botanist in agriculture, whose work is ultimately tested in terms of monetary profit or loss, and his academic brother whose achievement is assessed solely by his contributions to knowledge, " useful " or otherwise. Even this difference can easily be over-emphasised, since the one adds to knowledge whilst pursuing economic ends just as the other contributes to economic advances whilst pursuing knowledge for its own sake. Still, it undeniably does and must exist, and the unity of the science can be stressed more convincingly when divergences between its practitioners are frankly recognised. At the same time there appears only occasional need to distinguish by title the botanist in direct contact with crop production or plant industry from him whose contacts are indirect, and the more the two can realise their common interests the better it is for all concerned.

The outlook of the botanist in agriculture is determined by botanical analysis of crop production, and crop production represents the sum of interactions between constitution and environment. His problems therefore fall into two series, separable for purposes of discussion though interlocked in practice, those in crop genetics and those in crop physiology.

Provision to the agriculturist of genetically better planting material is perhaps the most important function of the botanist under present con-

ditions. It is not only a matter of plant breeding, though breeding may play a conspicuous part in certain cases. The collection, introduction, comparison and classification of species and varieties of crop plants represent a direct legacy from the days when botanic gardens were the main centres of agricultural research, and are still as important as ever.

Collection and introduction are returning to favour after an interval under a cloud. It is highly regrettable that the carriage of crop plants from one country to another has so often involved the carriage of pests or diseases as well, with calamitous results to the importing countries concerned. Yet the benefits conferred on agriculture as a whole by plant exchanges were even in the past immeasurably greater than the pathological consequences at their worst, and the important point about this particular risk is that to recognize it is largely to nullify it. With modern methods of plant quarantine available as a safeguard, there is less reason than ever there was for refraining from plant introductions *under proper technical control*. Classification, and systematic studies generally, are the basis of botany and hence of crop improvement. The imperfection of our knowledge of the systematics of tropical crop plants at the present day is responsible for losses no less serious for being largely unsuspected. One variety of a crop may be known under a whole list of names in different countries, or conversely several distinct types may pass under one and the same name. Such a state of affairs hinders co-ordination of results between research centres, causes unnecessary introductions to be made in some cases and desirable introductions to be omitted in others, and creates a general confusion in which time and effort are wasted that have a real and considerable cash value.

Crop taxonomy has to be much more detailed than the branch of the subject that deals with wild species, since the characters that separate agricultural varieties are finer than those used to differentiate species, and moreover are frequently as much physiological as morphological. Hence a herbarium technique is seldom applicable, and comparisons involve growing the varieties side by side and observing them at all stages. For similar reasons, type specimens, against which doubtful varieties can be compared for identification, should be maintained in the living condition as pure lines or clones if they are to be of real use, and the maintenance of type collections of tropical crops is a requirement as yet almost unfaced.

Studies of the origins and of the wild relatives of cultivated plants, in their bearings on the problems of collection, introduction and breeding, are scarcely less important than studies of the crops themselves. The centre of origin, if known, indicates the regions to be searched for types with new characters of agricultural value; the manner of origin, if it can be deduced, guides the breeder to appropriate methods, and the use of *Saccharum spontaneum* in sugar-cane breeding is only one example among dozens of the direct value of wild plants to the raiser of new crop varieties.

Detailed studies of quantitative variability within a crop are usually indispensable preliminaries to actual breeding operations, and the botanist

has to decide from them whether to proceed by hybridisation or by the less spectacular methods of simple selection that in mixed tropical crops are probably more frequently appropriate. The genetic survey of Trinidad cacao carried out between 1930 and 1934 provides many illustrations of the useful information that can be gleaned from such researches, particularly where perennial crops of long life-history are in question.

Selection of types among mixed crops is in itself a problem of no mean order. It involves at the outset a working definition of the word " best " for there is rarely, if ever, one " best " type for all conditions, and the aims of selection must be dictated by economic requirements. The relative importances of yield and quality have to be assessed in the light of some knowledge of local agricultural conditions and of the preferences of the markets, and before that can be done there must be an analysis of all the factors which go to build up yield, a similar analysis of factors contributing to quality in the crop, and a careful study of the interactions of the two sets of factors, which are sometimes antagonistic.

When hybridisation is found to be necessary, a new set of problems is opened up. Instances have been multiplied in recent years of advances achieved by intercrossing distinct botanical species, and everything points to a still greater use in the future of this particular method of crop improvement. Species crossing, whilst enlarging the potentialities of plant breeding, often presents its own difficulties to be overcome, and the microscopical examination of minute details of cell structure may have to be called to the aid of genetics for the direction of practical breeding. In banana breeding and sugar-cane breeding, for examples, as in the cases of several temperature fruits, cytology provides the only key to baffling behaviour in inheritance.

On the other hand, in cases especially frequent among perennial crops, such as cacao, the breeding of new types is of less immediate importance than correct propagation of the best among those already existing, and the task of elaborating propagation methods through research in plant physiology falls appropriately enough to the " plant breeder " in his wider capacity as a botanist.

Thus, if a team of specialists is available, there is work in genetic crop improvement for systematists, geneticists, cytologists and physiologists, but the common end is one, and frequently the various aspects are of necessity examined to the best of his ability by one individual. Neither the number of workers nor the funds available for research will at present allow a full team to every crop, and in any case each crop has its own peculiarities, and requires for its perfect investigation its own specially balanced team. Consequently the botanist, whatever his specialist label, must be able to appraise the situation from several angles and select the most appropriate lines of attack.

The function of botany in exploration of the relation of the plant to its environment is scarcely less important, though in this field it shares

responsibility with soil science and with plant pathology. The joint problem is to discover and describe in detail how the crop plant lives and grows and builds up its yield, in surroundings partly pre-determined by geographical and topographical factors and partly modifiable by agricultural practice.

The physico-chemical complexity of the soil and the tremendous importance of soil conditions in plant growth render imperative for the investigation of soil problems other specialists whose fundamental training is in chemistry rather than in biology. Similarly the multiplicity of parasitic organisms, including both insects and fungi, as well as other groups, calls for specialists in entomology and mycology to cope with the problems of crop pests and diseases. For the rest, it is the botanist who is concerned with tracing the plant step by step through its life-history, observing the effect upon it of varying conditions at every stage, and especially at those stages which are found to be most critical in relation to final yield.

Critical stages in the life history of the plant occur particularly in the development of crops which are grown for their fruits or seeds, and are often connected with the processes of pollination and fertilisation. Plants of complex ancestry are liable to exhibit partial or complete sexual sterility, and barrenness in certain varieties when grown alone or in certain combinations has been traced to this cause for several kinds of crop plants both temperate and tropical. This is a genetic aspect of a yield problem, but in other cases, unfruitfulness may be traced to other causes, such as malnutrition, which are primarily physiological.

The environment also includes for the botanist the complex reactions of one green plant on another, and in the case of budded or grafted plants, which are coming more and more into cultivation as the necessity of uniformity in produce is realized, the reciprocal influences of stock and scion provide him with a wide field for research. In the case of some crops, such as fruits, which are marketed in a living state, he has even to concern himself with the environment of the produce in storage and transport, in co-operation with the biochemist and mycologist.

Finally it is to be remembered that the botanist in tropical agriculture often has functions outside even the wide range of crop plants and their wild relations. Studies of natural vegetation are being increasingly recognized as economically important. To the agriculturist opening up new areas, the wild plant population is a useful indicator of soil and climate conditions. To the pathologist it is a reservoir whence come pests and diseases of crops, or more happily, wherein can be found natural enemies of pests to be turned to good account in biological control. Vegetation studies are practically impossible without identification of plants, and in many tropical countries the local floras are very imperfectly known. Consequently the collection and identification of species quite unrelated to his crops may legitimately find a place among the activities of the " economic " botanist. In these and many other ways he makes essential contributions to that solid basis of general knowledge upon which alone the various agricultural sciences can build.

THE PREPARATION OF SHADE-DRIED HIDES AND SKINS*

BY

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Buildings.

For the preparation of shade-dried hides and skins it is necessary to have a suitable building. Where possible, buildings of a permanent design should be constructed, as temporary buildings offer a number of disadvantages: they require continual repair, are often broken into by wild animals and dogs, and are not as a rule weather proof. It is obvious that these disadvantages must affect the finished article, and if a standardized product of good quality is aimed at the solution is permanent buildings. Thatched buildings are more suitable than those covered by corrugated galvanized iron, as they are not subject to such extremes of temperature. To make the building really rainproof, thatch should be laid on at an angle of 45 degrees; all timber should be of wood resistant to white ants and borers, and should be treated with solignum before being used.

The size of the building will naturally be governed by the supply of hides and skins. A plan of a suitable shade-drying shed is appended. This building is designed to take 12 hides and 12 skins at a time. In addition to this shed, a small godown is required for storage of hides and skins after their removal from the shed. This should be a building with a cement floor, and should be weather and vermin proof.

Preparation Prior to Drying.

Slaughtering.—Great care must be taken when bringing the animal to slaughter to ensure that the hide or skin is not damaged by beating, or by dragging the animal along the ground. Many hides are completely ruined in this way.

The animal should be thrown as gently as possible, and after the jugular vein has been severed the carcass should be allowed to drain until the flow of blood has completely ceased.

Flaying (Hides).—The carcass should be placed on its back and the hide opened up with a sharp knife from gullet to anus. Cross cuts are then made from hock to hock, running the knife down the outside of the leg and across the buttock. In the same way, a cut is made from knee to knee, this time running the knife down the inside of the leg and across the brisket. The shank ends should be cut off. The hide is now shaped ready for removal. Extreme care must be taken in flaying, as many hides are badly damaged during this process through slitting and gouging in an attempt to remove as much meat as possible.

* *The East African Agricultural Journal*, November, 1935.

It is far better to leave a little meat on the hide than to try to take off too much; surplus meat is easily removed later during the hanging and cleaning process. Various methods of flaying have been advocated, including elbowing the hide off or knocking it off by the employment of a wooden mallet. Anyone who has tried either of these methods will realize how unpractical they are when dealing with the average East African ox, which lacks subcutaneous fat. In the opinion of the writer, it is much better to use a sharp knife, and to take extra care while doing so.

Preparing for Hanging.—Having removed the hide, the tail should be cut off together with odds and ends, such as scrotum and sheath. The next process is to make incisions round the edge of the hide for hanging purposes. These incisions should be made at all the extreme portions of the hide, as this saves considerable trimming when it is eventually hung in the frame and also gives the hide a better shape.

The portion of the edge of the hide at which it is desired to make an incision should be wrapped half round a small stick, the hair side being next the stick. It is then easy to make an incision about one inch long on the flesh side with a sharp knife. If a stick is not thus used, it will prove difficult to make the incision.

This process is repeated until the required number of incisions have been made, usually about 35 for a hide or 25 for a sheep or goat skin.

If a cement floor is available, the hide should be placed flat upon it, and scrubbed on both hair and flesh sides with plenty of fresh clean water until all blood and filth are removed. If no cement floor is available, then the hide must be washed as well as possible under whatever circumstances prevail.

The hide is now ready for hanging in the frame, and it should be removed to the drying shed as soon as possible.

Skins.—The method described for hides also applies to sheep and goat skins, with the exception than in skinning a knife should only be used for opening up the skin. The skin itself is then prised off by using the closed fist.

Hanging and Cleaning.—A few short pieces of rope are now required for tying the hide temporarily to the frame. The hide should be hung neck downwards, with the hair side to the inside of the frame. The four legs should be tied to the four corners of the frame; this gives the hide a good shape when dry.

A long rope should now be taken and threaded through the incisions and round the frame, the temporary ropes then being removed. Over stretching should be avoided; the hide should be just tight enough to keep it in good shape in the frame. As it dries out it will tighten up naturally. Over-stretching damages the tissues, and is detrimental to the finished leather.

Having laced the hide into position in the frame, the hump should be stuffed with grass and a piece of wood should be stayed from the ground into the hump to keep the grass in position. If it is desired to hang two

hides to one frame this can be done by hanging them hair side to hair side. A stick of 1½ in. in diameter and 1½ to 2 ft. long can then be placed from hump to hump to keep the grass in place, and to allow a passage of air between the two hides. The hump itself is of little value for leather purposes, but if it is kept in shape and properly cleaned there is less likelihood of putrefaction setting up in this portion of the hide.

The next process is to remove the surplus meat, etc. This should be done with a sharp knife, and special care must be taken that it is not overdone. On the back at the butt end of most hides there are stripes of lean. These should be left on, as attempts to shave them off invariably result in gouging, with consequent damage to the hide. All oddments taken from the hide must be disposed of, and the shed swept clean daily in order to keep down the number of flies and other insects.

As a general rule, a hide will dry out in about 7 days in the dry season and in 10 to 14 days during the wet season. The best method of ascertaining whether a hide is properly dry or not is to feel the thick portions near the neck and also where the extremities are threaded to the frame. If these are dry, and there is no "hair slip," then the hide is ready for removal from the frame. The same method applies to sheep and goat skins, which usually dry out in 4 days in the dry season and in 6 to 8 days in the wet season.

Having removed the hide or skin from the frame, it should be placed flat upon the floor, hair side upwards, and should then be well brushed with a stiff brush. This removes all dust and dirt, and gives a nice sheen to the hair, which adds to its attractiveness.

When weather permits, hides and skins that have been shade-dried should be placed in the sun for a few hours for two or three days in succession. This completes the drying process, and also disinfects the hide or skin.

Folding.

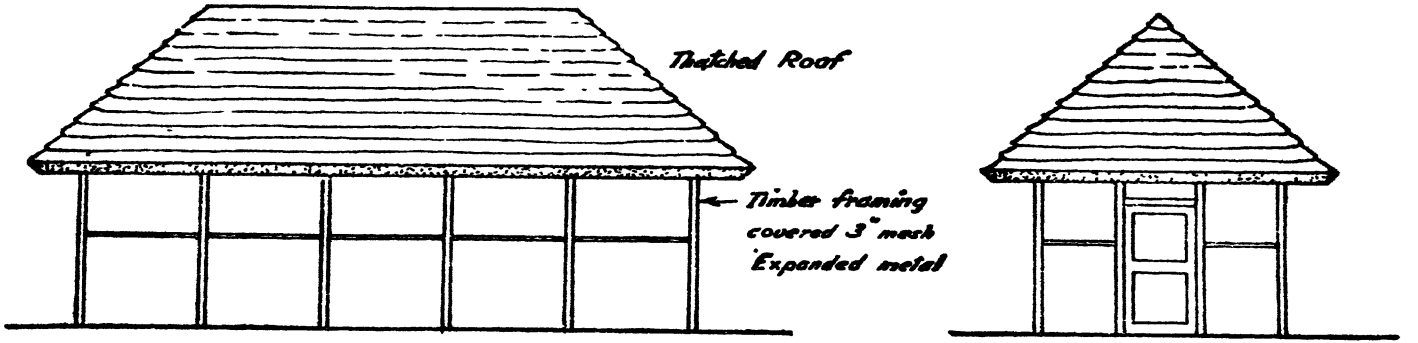
The most valuable side of a hide or skin is the hair or grain side. For this reason they should be folded with the hair side inwards. A straight fold should be made down the middle, and then about 9 inches of the flanks should be folded in. This tucks away the extremities, and makes a nicely shaped article which is easily handled.

Storage.

Hides and skins should be disposed of as soon as possible after drying. A good practice is to sell them every month. Care must be taken that they are well aired and that insects do not get into them. When weather conditions are favourable they should be taken from the godown and exposed to the air and sun at least once a week, and at the same time they should be examined for insects.

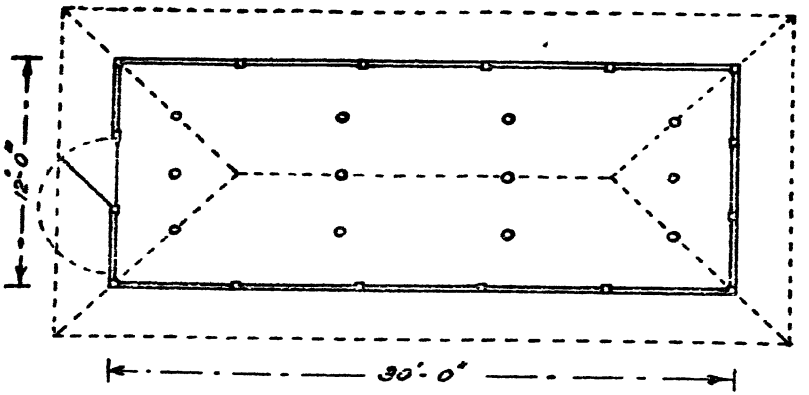
If disposed of every month and properly cared for during the time they are in the godown there is little risk of damage, but where it is necessary to store them for some time a sprinkling of powdered naphthalene should be placed between each piece on the hair side.

SHADE DRYING SHED FOR HIDES AND SKINS



ELEVATION

END ELEVATION



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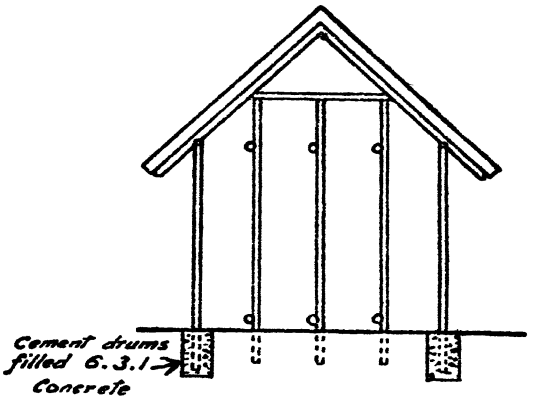

SECTION

THE
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THE
M.A.H.A. MAGAZINE

APRIL 1936.

EDITORIAL.

With this issue we enclose an index to the past three volumes Nos. 3, 4 and 5. In compiling this index we have been impressed with the wealth of material which has been compiled in the horticultural section of the Magazine and which is, therefore, at the disposal of all keen gardeners throughout Malaya. All of the articles deal specifically with Malaya, and, by reference to the index, it will be seen that they cover a wide field, from the important preliminaries of garden designing, the use of fertilizers, and turf maintenance to the introduction and cultivation of special plants not commonly met with in Malayan gardens.

We hasten to add that the foregoing remarks are not engendered by a pleasant feeling of personal self-satisfaction. They are, in the first instance, a tribute to the work of and help given by Mr. R. E. Holttum, the Director of Gardens, Straits Settlements, who has continued, since the revival of *The M.A.H.A. Magazine* in 1933, to be responsible for its horticultural section, a fact which older readers may have overlooked, and of which new readers will perhaps be in ignorance. They are, secondly, written with the object of drawing attention to the advisability of securing copies of back numbers, nearly all of which are available, though necessarily in a limited quantity.

While on the subject of horticulture we are glad to say that our appeal in the January issue for articles from readers met with a prompt response in the form of the account of " A Borneo Garden " by Mrs. George Ingate, published in the present number. We think it probable that, as in our own case, many owners of gardens suffer from sudden bursts of enthusiasm when they decide that something serious must be done in the way of transforming the mere compound—ugly word—into a real garden. But the efforts are sporadic and the results are only what one is entitled to achieve with waning enthusiasm.

A " Borneo Garden," on the other hand, is the well-merited reward for continued, unflagging work and enthusiasm. We ourselves feel spurred to further efforts, and we hope that the article will have the same praiseworthy effect on those of our readers who are too content to leave garden design (*sic*) to the doubtful capabilities and imagination of the *kebun*.

Mushroom Cultivation. A note of warning is perhaps advisable in connexion with the article on mushroom cultivation in Canton which is reprinted in this number. Experiments have been carried out during recent years by the Department of Agriculture in Province Wellesley and Penang, Kedah, and elsewhere, but the results were not invariably satisfactory.

As the editor of *The Malayan Agricultural Journal* pointed out in the February, 1935, issue of that journal, it is evident that, given the proper conditions, a certain variety of mushroom is suitable for cultivation in Malaya, but it is equally evident that the ideal conditions are as yet imperfectly understood.

Thirteenth Malayan Exhibition. We would again draw our readers' attention to the forthcoming Malayan Exhibition to be held in Kuala Lumpur during the August Bank Holidays, the 1st, 2nd and 3rd August. Full particulars can be obtained from the Secretary, Malayan Agri-Horticultural Association, 8, Barrack Road. Kuala Lumpur.

Horticulture.

A BORNEO GARDEN

BY

DOREEN INGATE.

This is not a technical treatise on gardens but merely a record of our own experiences and amateur efforts towards the planning and constructing of a tropical garden on a moderate income.

In making a garden there will be many disappointments and many obstacles to surmount, but the finished result, on a fine sunny day with the birds singing, will more than compensate for everything.

Three years ago the site of our present house and garden was a somewhat neglected coconut estate. To-day it is a colourful garden admired by many passers by. Naturally several coconut trees had to be felled but we left those on the boundaries of the estate round which we now have a thick bamboo fence. The site of the present lawn was a very flourishing crop of "lallang." This had to be entirely eradicated, and, after a great deal of changkolling and a great deal of rain, we wondered how the patch could possibly ever look like a garden.

Undoubtedly laying the lawn was our biggest task. The whole changkolled patch had to be levelled, raked, treated with lime, rolled, planted with clumps of grass approximately six inches apart (seeds are not a success here), and then re-rolled. For want of sufficient grass of one species, several sorts were planted. The Bermuda grass has won the race for supremacy, and, after three years, has completely eliminated the "love grass" and other miscellaneous grasses. We have found that the Bermuda grass needs cutting very frequently, for, being of a straggly nature, the roots become exposed when long grass is eventually cut, and leave a forlorn brown appearance as though drought-affected.

Next came the question of drains. The sight of these was depressing, but by judicious use of rustic bridges, and allowing short grass to line the ditches without blocking them, we can now almost imagine they are little streams.

Hedging and fencing was the next item on the agenda. Owing to the poultry the whole block of gardens had to be fenced in with small-meshed wire netting. This at first was very ugly, but now the "box" hedge completely hides the wire netting. Our experience of hedging is that the Hibiscus is the quickest growing and hardiest, and is always a brilliant green, especially across the top where the young shoots sprout. We planted these hedges in trellis manner, the cuttings being approximately eighteen inches long. It should always be remembered that when the hedge is mature it is approximately two to two and a half feet wide across the top, so sufficient space should be allowed between the hedge and the wire netting.

With the fence up we could start and plant out our shrubs. In order to have these ready to plant at the right time the cuttings were taken as soon as the work of clearing the garden site began. This is well worth noting.

Not being able to afford many gardeners we have concentrated on perennials, crotons and cannas, of each of which there are too many varieties to enumerate here. Dr. G. A. C. Herklots of Hong Kong has given a very complete list of these in the January issue of the *M.A.H.A. Magazine.* I need only mention that the Hibiscus, Bauhinias, Bougainvilleas, etc. give a splendid show in a very short time.

Although we had voluntarily left coconut trees standing, we felt we could beautify the trunks to some extent. We experimented successfully with the Tonkin bean, Ipomoeas, Petrea, Congea, Allamanda, Indian myrtle etc. These plants are not parasites and so do not damage the trees, and although they need endless tying up and nailing, the result is worth it.

After the first eighteen months we became more ambitious. The lawn looked bare although we did not want it broken with flower beds. A bird bath was suggested, so this was ordered. It consists of a small figure sitting in a basin on a decorative pillar and plinth. These garden figures in synthetic stone guaranteed to withstand tropical conditions can be purchased from any of the leading London stores at a reasonable price.

We also imported some assorted Zephyranthes, cleared a space round the bird bath which the wild birds now patronise every hot afternoon, and planted them. Zephyranthes are the nearest tropical flower to our English crocus but grow taller. They are available in white, pink and yellow.

Gradually we purchased a few more of these garden figures. " Jeremy " a large frog keeps watch across the lawn from a Bougainvillea bush. " Phoebe," a small nude figure stands under a " tĕrap " tree ready to plunge into a large local " kima " shell. A giant bi-coloured creeper (pale green and dark green variegated) entwines its tendrils above her head. The tĕrap tree has been sacrificed to this creeper. The pigeons bathing in Phoebe's kima shell add a touch of beauty to the surrounding garden. We also noticed that the local " Java sparrows " were very partial to grass seeds, so in the " Phoebe Garden " the grass is allowed to grow to meadow length. A pair of stone vases stands at the entrance of an arch, and green painted wooden garden seats were added from time to time.

A year later we read " Down the Garden Path " by Beverley Nichols which inspired us to further efforts. Everyone should read this delightful book. We took in approximately another quarter of an acre of coconut estate and treated it in the same way as the original garden except that round this piece of lawn runs a paved path (large round stones embedded in an earth foundation), with arches at intervals.

It may be of interest to know that it pays to spend a little extra money and build one's arches of split billian posts. These are practically permanent and give a resemblance to " rustic " wood, whereas the ordinary

soft jungle timber rots in a year or so, and arches then all have to be renewed. Over these arches we are training successfully English honeysuckle, Tonkin bean, Honolulu creeper (white), Bougainvillea (*B. Thomasii*), Congea etc. The Bougainvillea so trained closely resembles an English crimson rambler. Hibiscus bushes grow round the edge of the lawn and are pruned to represent rose bushes. The double white, pink and scarlet particularly lend themselves to this method of pruning.

. In the meantime we had collected numerous ferns and other pot plants but had no fern house for them, so we decided that one end of the " Beverley " Garden should be arched the whole way with grenadilla vines (*Passiflora quadrangularis*), a plant with an exotic bloom and edible fruit. These vines completely covered the framework in a few months, and the shelter so formed makes a very effective temporary fern house. Here I should like to mention that a member of the M.A.H.A. has, since, kindly supplied me with sketches and detailed instructions for making a fern and orchid house.

Lastly we built a rockery. This must not be confused with a rock garden which is a much more ambitious undertaking. Our rockery was made by first building a mound of some poor soil which we wanted to get rid of to make way for some richer loam. Over this mound several loads of good rich soil were poured from above and then lightly pressed down. A retaining wall of coral was built round the base of the mound, and more rough lumps of coral were then pressed on to the earth mass all over. The small gaps so formed were planted with small ferns and other suitable plants, all of which are available from the Singapore Botanical Gardens. I would, however, suggest that these rock plants be selected personally so that an idea of how they spread can be gained. Our experience has taught us that the plants we tend carefully in pots frequently die, but the same plant in a few inches of soil, and wedged between two lumps of coral spreads and flourishes to a prodigious degree. Such is the perversity of Nature ! The whole structure is about 10 feet in diameter and 4 feet high, and two green glazed earthenware frogs from Hong Kong live on it. " Kima " and other decorative shells or coloured stones also enhance the natural beauty of the rockery.

But now we must stop expanding and carry on the ordinary garden routine which is never ending. There is, however, one warning. Do not make your garden bigger than your pocket. In other words it is better to have a small, neat, but not necessarily severe garden, than a large untidy one. A practical working method for a garden of about an acre in area is to have two gardeners. One to scythe the lawns, clip the hedges, sweep up fallen leaves, and carry water during a drought. The other, who should be a more experienced man, to prune, manure, graft, propagate etc. This is our own arrangement and, with our own spasmodic efforts on free evenings, makes a good combination.

I should like to mention that the Singapore Botanical Gardens sell plants at very reasonable prices. These plants are despatched in small earthenware pots,—very useful later for cuttings and other forms of plant propagation. The pots are carefully packed in fibre in Wardian cases and 90 per cent. of them have reached us alive.

We have also obtained plants from Ceylon, and a good proportion of these also arrive alive; but these plants are only packed in moss and fibre, and not in pots.

CHONEMORPHA: A NEGLECTED GENUS OF FLOWERING CLIMBERS

BY

C. X. FURTADO, B.AG.

Chonemorpha is a small genus comprising about a dozen woody, large-leaved twining climbers, indigenous to the Indo-Malayan region and Ceylon. Botanically the genus belongs to the family *Apocynaceae*, which includes not only many medicinal plants but also several ornamental ones, examples of the latter being Frangipanni, Allamanda, Beaumontia, Kopsia, Odontadenia, Oleander, Thevetia and Vinca of our gardens. All *Chonemorpha* species bear large bunches of creamy-white flowers. The corolla, which is also very large, is narrow and tubular at the base and divided into large, peculiarly twisted segments above. In bud the flowers are frequently pinkish or purplish. When in full bloom, the large flowers with their sweet scent make an attractive and pleasant sight. To enable the plants to make their full show, however, an open or unshaded place with plenty of room for spreading is necessary. The species are readily propagated by cuttings or by *bungkusing* (layering) and may be grown as shrubs or made to climb over pergolas, plant-houses or railings. In spite of the little care that is required to grow them successfully, *Chonemorpha* plants are seldom seen in any of the local private gardens. Very fine specimens are to be seen covering the roofs of plant-houses in the Waterfall Gardens, Penang and the Public Gardens, Kuala Lumpur. The Malay name for the plant is *Akar Geripmerah*.

Only three species are known in local gardens, and all these three are so very much alike in their general appearance and in their range of variation in the shape, size and hairiness of the leaves that, unless one grows them side by side, they are seldom recognised as distinct. They may be distinguished most easily by the form and hairiness of the calyx, as indicated in the key at the end of this note. The names of these three species and their range of distribution are as follows:—

1. *C. macrophylla* G. Don: Of the three species this produces the largest flowers and is also the most widely distributed species of the genus, being found as native in Northern India, Burma, the Andamans, and the Malay Peninsula; Perak is the only State where it has been so far recorded as wild in the Peninsula. The Kuala Lumpur plant is this species.

2. *C. penangensis* Ridley: Despite its name, this species is also found wild in other places than Penang Island, viz: Selangor, Malacca, and Negri Sembilan; but it is not known to occur outside the Malay Peninsula. The plant on plant-house No. 3 in the Waterfall Gardens is this species.

3. *C. fragrans* Alston: This species occurs in Ceylon, and in Malabar (India) in a tract lying between the coast and the mountains at an altitude of about 2,000 feet. From Ceylon, (whence it is still being

Chonemorpha macrophylla

distributed under the name *C. macrophylla*) it was introduced to the Singapore Botanic Gardens in the year 1883 and it has grown extremely well. In altering the plant-house it was cut back, and is not now showing its flowers.

Key to the three species of Chonemorpha.

A Leaves of flowering shoots obovate or elliptic, with the greatest width above the middle; base obtuse or cordate. Calyx about 10-12 mm., rarely less long. Lobes comparatively short, triangular, acute.

a: Calyx almost hairless, dilated at the mouth (campanulate):

1. *C. macrophylla*

aa: Calyx distinctly hairy or velvety, slightly contracted at the mouth (urceolulate):

2. *C. penangensis*

AA Leaves of flowering shoots ovate, oblong or suborbicular, with the greatest width in the middle or below it; base cordate. Calyx 7-10 mm. long, without hairs, campanulate. Lobes about half the length of the calyx, gradually and arcuately narrowed towards the apex, overlapping at base.

3. *C. fragrans*

THE BERMUDA ISLANDS

BY

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Botanic Gardens, Singapore.

Before coming to Malaya I was fortunate enough to be stationed in the Bermudas, a small and isolated group of islands in the North Atlantic Ocean. Conditions there were most favourable for gardening and plant growing, for, with the exception of an occasional strong wind, there was nothing to check the growth of vegetation to any large degree. The mean temperature ranged from 65°F. during the early part of the year to 80°F. in the summer. Rainfall was moderate and evenly distributed. Frost was practically unknown.

The soil of the Islands, though quite rich and sweet in nature, proved to be the only drawback. It was exceptionally shallow and porous, tending to dry out rather too quickly. In many parts it was but a few inches in depth, and had it not been for the soft nature of the underlying rock, few plants would have survived in it; as it was, planting holes had to be blasted out before any large plantings could be attempted. The genial climate, augmented by the regular rainfall to a large extent compensated for this soil condition and a rich growth of plants was to be found everywhere.

As may well be expected, the native flora was not rich in variety. Only plants whose seeds were transportable by wind, ocean currents and migratory birds had been brought to the Islands before the latter's discovery early in the sixteenth century. This is revealed by Lefroy in his Botany of Bermuda published in 1879. He stated that the native plants numbered 150 species, of which but 15 were indigenous. These have been supplemented by some 400 others, introduced by the seafaring people of that period and years before. To-day it is estimated that this number has been increased to about 3,000, a creditable increase considering the area of the Islands is but 19¼ square miles.

The characteristic tree is the Cedar (*Juniperus bermudiana*) which is so plentiful that it gives the impression of being the only contribution to the Islands' sylviculture. Holding on to the shallow-soiled hillsides by spreading roots empowered to abstract nourishment from almost pure limestone, it has successfully overcome the varied and diverse conditions which have at different times prevailed.

Nestled amongst these trees are the homes of the people, bungalow style most, and almost without exception built of the Islands' limestone. The building stone is usually quarried from the very land on which the house is built. The quarries are later used in making sheltered gardens for ferns, Begonias and many other more delicate plants.

About the homes one usually finds well kept lawns, borders of bright flowers and a miscellaneous assortment of shrubs, vines, trees and palms, all arranged in a very simple and unconventional manner.

A Bermuda Garden: Cedars, Royal Palms, and a Herbaceous Border

Phot Rutherford.

A Lily Field in Bermuda

Phot Rutherford

Oleander time in Bermuda is a sight worth seeing. The delicate pinks, reds and white of their blossoms, accentuated by the deep blue of the sky and sea, make a floral picture which can never be forgotten. Introduced about 1870, the Oleander (*Nerium oleander*) was first regarded as a rare exotic. To-day it is unusual to find it as a cultivated plant, for, taking to local conditions with ease and facility, it is now found generally throughout the Islands. Of extremely rapid growth, it frequently attains a height of some thirty feet, with long arching branches, massed with blossoms, reaching to the ground.

Other shrubs, too numerous to mention, also grow in great profusion; many are quite common in Malayan gardens.

Annual flowering plants are a source of pride and admiration to the local aspirants, who grow them to unbelievable size and perfection. The South African Veldt daisies—Gerbera, Arctotis, Gazania and many others, abound.

Any reference to Bermuda cannot be complete without some mention of the bulbous plants. Amaryllis, Gladioli, Crinums, Freesias, to mention a few, do remarkably well and are very much at home in natural settings. Garden escapes are numerous and it is not uncommon to find plants prized in other countries growing wild along the roadsides and in woodlands. To the visitor, Bermuda's contribution to plant life will always be the lily fields, which are in full bloom at Easter-time. Lying between rocky Cedar-studded hills, these fields present a picture. The erect waxy blooms, covering the ground like a white carpet, make a striking contrast to the somewhat sombre green of the surrounding vegetation.

To make a comparison between the plants of the Bermudas and those of Malaya with which I have come in contact would be rather unfair to either country. Nevertheless a few observations may be of some value to local gardeners.

It is very noticeable that there is a marked difference in growth between many of the plants common to both places. This is not due so much to climatic conditions as soil. As has already been mentioned, the Bermuda soils are very light and well drained, being almost entirely formed of the weathered and disintegrated aeolian limestone rock. This rather sandy, alkaline soil seems particularly to suit bulbs, most annuals, and a number of shrubs. Oleanders, Duranta, Hibiscus, Poinsettia and other euphorbiaceous plants do very well. I have observed Poinsettias with heads of bracts more than twelve inches across and Hibiscus bushes fifteen feet high. Perhaps a free use of sand, other opening materials and lime might improve conditions for many local plants which are not too happy.

There are several plants which would be valuable introductions to Malaya, *e.g.* the Olive-wood Bark (*Elaeodendron Laueanum*) which is characterized by a striking contrast between the pale yellow-green of its young foliage and the deep-green of the older leaves. It forms a dense bushy tree to twenty feet high. Another plant which might be useful is

Darrell's Fleabane (*Erigeron Darrellianum*), a small shrubby member of the Compositae family, which is covered with a mass of daisy-like flowers during the early part of the year. Both are indigenous to the Island.

Of the exotic plants the Scarlet Cordia (*Cordia Sebestena*), an evergreen tree of fifteen feet high, with ovate entire leaves and clusters of orange-scarlet tube-shaped flowers, is very attractive. The snow-bush (*Phyllanthus nivosus*), a native shrub of the South Sea Islands, is useful for hedging. It is distinguished by the white, pink and purple variegation of its young foliage. The yellow Jacobinia (*Jacobinia aurea*), hailing from Central Ameria, is, like its sister species *Jacobinia coccinia*, an upright shrub of about six feet tall. No doubt it is the finest of the genus, for its yellow flowers are born in a dense terminal spike often ten or more inches long; the individual flowers are two inches long.

Two other members of the Acanthaceae family, *Odontonema strictum* and *Beloperone guttata* are worthy of mention. The former is an upright shrub of some six feet high, having simple, glossy leaves, and terminal branched inflorescences of deep crimson flowers, while the latter is a low, much branched, soft wooded shrub, ornamental in that it bears a profusion of reddish-brown bract-enveloped flowers the year round.

Solanum Rantonnetii, commonly known as the Blue Potato-bush, is very pretty. Its slender stalks are clothed in small elliptic leaves, which are interspersed with few-flowered, axillary clusters of dark blue-purple flowers.

The various species of Pittosporum should also prove to be valuable for hedge and specimen planting.

In conclusion it may be said that there are a large number of plants of the western tropics and sub-tropics which have yet to make their debut in Malaya. Those of the Bermudas play but a small part, but a sufficiently large enough one to show the possibilities of such introductions.

MALAYAN PLANTS FOR MALAYAN GARDENS*

BY

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Flowering Shrubs.

Ixora. (Rubiaceae). Pĕchah Pĕriok, etc. There are 25 native species of Ixora; they are mostly shrubs of shady forest or river banks. Four are large trees. Most of the shrubby species would be worth cultivating, and should be hybridised with the species from India and Southern China which are usually grown in gardens. A little hybridising has already been done in the genus. *Ixora Scortechinii* is a very beautiful dwarf shrub, requiring shade; it is very slow in growth, but would be an excellent pot plant.

Clerodendron (Verbenaceae). At least three local species are worth cultivating, and the genus is one in which hybridisation experiments would be well worth while. *C. paniculatum* (Pagoda flower) is very widely distributed in S. Asia; its pyramids of small red flowers are attractive. *C. myrmecophilum*, a local species, has a rather similar habit, the flowers orange, the stems hollow and ant-inhabited. It is native in wet places in the south of the Peninsula. *C. penduliflorum*, distributed from Burma southwards, has beautiful pendulous groups of white flowers. It makes an attractive pot plant, and likes a little shade.

Jasminum (Oleaceae). There are 14 wild Jasmines in the Peninsula, and some of them are worth cultivating for their flowers. The commonest, and one of the best, is *J. bifarium*, a scrambling shrub with masses of star-shaped fragrant white flowers. *J. kedahense* and *J. Maingayi* are probably the finest, the latter growing in hill forests at moderate altitudes; allied to these is the Siamese *J. rex*, which has very large flowers. The very fragrant double Jasmine is introduced from India.

Rhododendron (Ericaceae). There are 19 species recorded as occuring in the Peninsula; they are mostly shrubs or small trees of mountain ridges; one is a large tree, and a few are epiphytic shrubs. Almost all have very fine flowers, and are well worth attention at our hill stations, especially Cameron's Highlands. Several of the local species were introduced to European hothouses in the 19th century, and also some from Borneo and Java. A few of these were hybridised by the firm of James Veitch & Sons, Limited, from the seventies onwards, and a series of beautiful new forms produced which have been grown as warm greenhouse plants in England. The original hybrid between *R. jasminiflorum* and *R. javanicum*, "Princess Royal," is still grown; both these species occur in the Peninsula. The Bornean species *R. Brookeanum* and *R. Lobbii* were also used. Some of the green house hybrids should certainly be brought out to Cameron's Highlands,

* **Substance of a lecture delivered to the Selangor Gardening Society, October 1935.**

and grown alongside the native species. The culture of Rhododendrons, even at Cameron's Highlands, might require rather carefully controlled conditions, but it would be well worth trying, and the results might transform the appearance of our hill stations.

The species *Rhododendron longiflorum* was formerly found on a big tree on Bukit Timah, Singapore, and so might be grown in the lowlands, if the right conditions can be found. Also *R. Teysmanni* has been found at Penang Hill, and evidently does not demand any great altitude.

Bauhinia acuminata (Leguminosae). This is the only local shrubby Bauhinia; the others are climbers. It is a medium shrub, with pretty white flowers. The allied larger bushy or small tree species, *B. monandra* and *B. purpurea*, are native further north, in Burma.

Pseuderanthemum graciliflorum (Acanthaceae). A shrub of lowland forests, with pretty mauve-blue flowers which are produced in dry weather. It is easily cultivated, and worth growing in shady thickets in gardens, where few plants will flower. It has also been called *Eranthemum malaccense*.

Holarrhena (Apocynaceae). Three species of this genus occur as small white-flowered shrubs in open country of Kedah and Perlis. They are worth cultivating in the north of the Peninsula, and they flower freely. An allied Indian species is a small bushy tree, which is also well worth cultivating in the north.

Kopsia singapurensis (Apocynaceae). A small tree, rather common in the freshwater swamp forest of Singapore and Johore. It has white flowers with a pink eye, which are produced very freely at fairly frequent intervals. It grows well in a low screen of trees. The allied species *K. fruticosa*, with pink flowers, often seen in gardens, comes from Burma. These might well be hybridised.

Orthosiphon stamineus (Labiatae). Kumis kuching. This dwarf shrub with its pale lilac flowers, is native in the north of the Peninsula. It makes a useful, though not very showy, bedding plant, and is valuable medicinally.

Memecylon caeruleum (Melastomaceae). A shrub, found in sandy open spots, and edges of forest; it has small flowers of a fine blue colour and a small fruit said to be edible. The foliage also is pleasing, and the shrub is worth a place in the garden.

Fagraea auriculata (Loganiaceae). This species is widely distributed in the Malayan region. It is a large shrub, either epiphytic or on rocks near the sea, and has very large flowers (see this Magazine, Vol. 4 No. 2). There are also several other species of Fagraea, mostly epiphytes, which might also be grown as garden shrubs. They flower usually once a year.

Medinilla (Melastomaceae). There are 13 species of this genus in Malaya; they are mostly shrubby epiphytes of mountain forests. Nearly

all are decorative, the finest being very beautiful, with masses of pink flowers on red stems. *M. speciosa*, a shrub 4 or 5 feet tall, is one of the best. These plants would want a moist shady place, probably more moist and shady than most garden plant-houses.

Foliage Shrubs.

Few native shrubs are grown for the beauty of their foliage. Three small-leaved plants from the dry open country of the north make trim hedges; in these it is the small size and neat formation of the leaves that are attractive, and the capacity to withstand trimming. The three are: *Acalypha siamensis* (Euphorbiaceae), *Ehretia microphylla* (Rutaceae) and *Streblus asper* (Utricaceae). For an account of these, see this Magazine, Vol. 4 No. 1.

The Dracaenas of gardens are mostly of Papuan origin, and belong to the genus Cordyline. In the Peninsula are 21 native species of true Dracaenas, some being quite large trees. Most of them are of no special decorative value, though their rather unusual foliage is pleasant; the most ornamental is *D. aurantiaca*, found in wet places, which has large variegated leaves.

Euphorbia antiquorum, a large, much-branched, thorny, leafless Cactus-like shrub, is found on the limestone in the north of the Peninsula. A well-grown plant is handsome in an appropriate place in the garden. The flowers are small, and the chief decorative value of the plant lies in its massive dark green curiously-angled stems.

Climbers.

Bauhinia (Leguminosae). Daup-daup; Tapak kuda. There are several very large climbers of this genus which have very fine flowers, usually orange in colour. The commonest is *B. bidentata*, which often covers the crown of forest trees with orange; it is however too large for ordinary garden purposes, and usually only flowers once a year. The best of the Bauhinias for the garden is *B. kochiana*, found in south-east Johore and in Sarawak. This flowers at a moderate size, and frequently; it can be grown over an old mangosteen tree, or supported by an arch or trellis. It rarely sets fruit.

Congea velutina (Verbenaceae). This is the well-known Congea of gardens. It is native from Burma south as far as Province Wellesley, and is one of the finest of local plants for garden purposes.

Tristellateia australasica (Malpighiaceae). This slender yellow-flowered climber is found in mangrove vegetation, and is widely distributed in Southern Asia, and through Malaysia to Queensland. It is very useful as a garden plant, flowering freely.

Quisqualis indica (Combretaceae). Rangoon Creeper; Drunken Sailor. This large climber is native from Burma southwards and has been found wild in the north of the Peninsula and on the Pahang coast.

Thunbergia laurifolia (Acanthaceae). This has about the same distribution as Quisqualis. Its long inflorescences of large pale blue flowers are very handsome, but it is a troublesome weed if it gets loose in shrubberies or screening thickets of trees, growing over their crowns and smothering them.

Chonemorpha penangensis (Apocynaceae). This is a very large climber with large creamy white flowers, very handsome on the roof of a plant house or large pergola, needing plenty of room. It has been found wild in many places in the Peninsula. *C. macrophylla*, which has rather larger flowers, and is widely distributed, also occurs in the Peninsula. The allied genus Beaumontia, more often seen in Malayan gardens, has a few species which are native from Northern India to Indo-China.

Hosea Lobbiana (Verbenaceae). This slender climber is native of Sarawak, but may be mentioned here, especially as it commemorates Bishop Hose, who made valuable contributions to Malayan botany, and Thomas Lobb, collector of many Malayan plants for garden cultivation. The decorative parts of the plant are the large apricot-coloured bracts which are borne with the flowers.

Mussaenda mutabilis (Rubiaceae). This is a large climber with attractive star-shaped flowers which turn from yellow to deep orange-red. It is fairly common in forests. Other species of Mussaenda have showy almost white bracts as big as foliage leaves.

Raphistema pulchellum (Asclepiadaceae). This climber is distributed southwards from Burma and southern China, and has been found at a few places in the Peninsula. It is allied to Stephanotis, but the flowers are not so fine. See this Magazine, Vol. 5 No. 4.

Hoya (Asclepiadaceae). There are 25 species of this genus in the Peninsula. The flowers are waxy, borne in compact heads, usually white or pinkish, and decorative in a formal way. The leaves are thick and fleshy, and some are pleasantly variegated.

Vitis discolor (Ampelidaceae). This is a slender climber found on rocks in shady places in the north, allied to the grape vine. The leaves are beautifully variegated, and it makes a good basket plant or climber for the shady plant house.

Piper (Piperaceae). There are many species of wild pepper in the Peninsula, and several of them are rather decorative, especially when in fruit. Some of them have finely variegated leaves as young plants, or on the stems near the ground in the deepest shade of the forest. Of these, the best is *P. porphyrophyllum*, which has thin, finely velvety leaves, purple beneath and dark green above, spotted with silver which turns to pink.

Ficus (Moraceae). There are several climbing species of this genus, but only one is of possible horticultural use, *F. punctata*. This has small leaves borne on stems which climb like Ivy. It is very similar to the ivy-like creeper which is quite commonly grown to cover walls; this

creeper is *F. pumila* and is native of Southern China. *F. punctata* could be used in the same way.

Nepenthes Pitcher plants. Pitcher plants are not usually grown in Malayan gardens, though they are native of Malaya and are often cultivated in hothouses in Europe for their interest and for the beauty of their pitchers. The finest species are mostly from the mountains, and do not take kindly to lowland conditions: the finest of all are from some mountains in Borneo. The best lowland species is *N. rafflesiana*. Many Nepenthes species have been hybridised in European nurseries, and some very fine forms have resulted, but these do not seem to produce pitchers so freely under Malayan conditions. More experiment on the best conditions for pitcher production under local cultivation is required.

Flowering Herbaceous Plants

Gesneraceae This family contains a large proportion of the ornamental herbaceous flowering plants native in Malaya. It is the family of Gloxinia, Achimenes and Streptocarpus, most of the local plants being nearest in habit to the last. Nothing has yet been done to bring these plants into general cultivation, nor to hybridise them. Most of them are difficult to cultivate in the lowlands, being native of mountains; and most are shade-loving plants which will not tolerate open garden conditions. Their variety and beauty are, however, so great that some attempt ought to be made to grow them, and it is quite possible that under skilled treatment and in the course of some generations of breeding, very fine hybrid strains could be produced.

The genus *Didymocarpus* is the largest locally represented, having 56 species in Mr. Ridley's *Flora*. Other genera are Didissandra, Loxocarpus, Boea and Paraboea. The last three have smaller flowers in most cases, but some of them are limestone rock plants which tolerate more exposed conditions than most species of Didymocarpus.

The genus *Aeschynanthus* consists of slender epiphytic creeping plants with bright red flowers, nearly all being very attractive, though not all flower freely. Some are confined to mountains, but two are not uncommon in the lowlands.

Impatiens (Balsmainaceae). There are over a dozen species of Impatiens native in the Peninsula. Some are mountain plants, usually growing in wet places near streams; others are lowland plants, found on limestone rocks in shady places. The mountain species are all pink except *I. oncidioides*, which is a beautiful yellow. The limestone species are white or sometimes yellow, mostly not so showy. The finest is undoubtedly the yellow mountain species, which is common at Fraser's Hill and Cameron's Highlands. It does not take kindly to lowland cultivation. If it could be introduced into a series of local hybrids, the results might be very remarkable, and would certainly add interesting new plants for our hill stations.

Sonerila (Melastomaceae). This is a large genus of small herbaceous plants, mostly of mountain forests. They usually have rather small pink flowers in clusters, and decorative (sometimes variegated) leaves. Several species would be worth cultivating in a shade garden at hill stations.

Acrotrema costatum (Dilleniaceae). This is a small prostrate plant, with beautifully variegated leaves and pretty yellow flowers. It is worth growing in a shade rockery, and is found in forests throughout the Peninsula.

Tacca (Taccaceae). Black Lily. These plants have curious purplish-black flowers, with long slender bracts like whiskers, and are locally common in lowland forest. There are two species. They are useful in a shady corner of the garden.

Crinum asiaticum (Amaryllidaceae). Bakong. This large lily-like plant is widely distributed in Southern Asia, and is common in sandy places near the sea in Malaya. For information about this and other species of Crinum see this Magazine Vol. 5 No. 4.

Eurycles sylvestris (Amaryllidaceae). Daun Sapenoh. This is another lily-like plant found near the east coast. It has handsome broad leaves and a group of dainty white flowers. The bulb rests from time to time.

Ginger Family (Zingiberaceae). Many members of this family are found in the shade of Malayan forests. The best for garden purposes are some species of Alpinia, which have flowers at the end of a leafy stem. Other genera have the flowers on a short separate stem; they are interesting to grow, but not many are really showy garden plants. Plants of the genus *Globba* are much smaller than most members of the family, and some of them are very dainty; they all require shade, and the best are mountain plants. The species of Kaempferia have in many cases decorative variegated leaves. The prettiest local species is *K. pulchra*, found on limestone rocks in the north. In a shady rockery this is very pretty, flowering seasonally with small lilac-coloured flowers just above ground level.

The Indian *Hedychium coronarium* is often grown locally for its fragrant white flowers. The best local member of the genus is *H. longicornutum*, which is an epiphyte, growing on trees like an orchid; it has beautiful orange flowers.

Foliage Herbs.

Begonia There are a number of very decorative native Begonias, mostly in shady mountain forests. Some of them would be worth growing, and crossing with the hybrids of the Assam *Begonia Rex*, which are already commonly grown in Malaya.

Phrynium and **Stachyphrynium** (Marantaceae). These members of the arrowroot family have decorative leaves, sometimes variegated. They are useful as foliage pot plants in shady places, or in a shady rockery.

Aglaonema (Araceae). These plants are found on limestone rocks in the north. They bear numerous short-stalked leaves, variously ornamented, on the creeping rootstock; they are useful for foliage pot plants in light shade.

Alocasia (Araceae). Several species of this genus have decorative leaves. The finest is *A. lowii*, on limestone rocks, which has glossy dark green leaves with pale veins.

Schismatoglottis (Araceae). These are plants of shady forests. A few are of some decorative value as foliage plants, but they are not so handsome as many other Aroids.

Cyrtosperma (Araceae). There is a very fine tall species of this genus, which makes a very handsome subject for the back of a group of aroids, or when a tall plant (leaf-stalks to six feet) is wanted. The plants do best in wet ground.

Water Plants.

Nymphaea pubescens and N. stellata These small water lilies are found in local ditches and other open water. They are not so fine as the hybrids of *N. lotus* and other species which have been introduced from other countries.

Nelumbium speciosum (Nymphaeaceae). Indian Lotus. The common pink form of this species is locally abundant (though doubtfully native) in shallow water in many parts of the Peninsula and is often cultivated. A white variety is also cultivated, and probably other varieties introduced from China and Japan. More of the modern varieties should be tried locally.

Monochoria clata (Pontederiaceae). A tall plant with blue flowers, found in rice-fields in the north. For description and photograph, see this Magazine, Vol. 5 No. 4.

Limnanthemum (Gentianaceae). This pretty floating herb has leaves like a small water-lily, but the small feathery white flowers are quite different. It is a very attractive plant for open tanks or ponds, needing no attention and flowering freely.

Cryptocoryne (Araceae). There are several small species of this genus with pleasantly variegated leaves. They grow quite submerged in shallow water in shady places and are most useful plants for small aquaria to be kept indoors. Unlike most other water plants, they thrive in a rather poor light. The aquarium sets them off to advantage as their beautiful colours can be seen much better from the side than when viewed only from above.

Ferns.

Malaya is very rich in ferns, but few local species are in general cultivation. The commonly cultivated maidenhairs are all from tropical America. There are two local species allied to the maidenhairs, both found on rocky places, especially the limestone in the north of the Peninsula;

they are *Adiantum caudatum* and *lunulatum*. These are small ferns with narrow drooping fronds, and make pleasant basket plants.

Probably the most generally useful ornamental fern to be found locally is the Chinese lace-fern, widely distributed in Southern Asia, and common on recently cut banks beside paths at our hill stations. Though generally only found in the hills, it can quite easily be grown in the lowlands. Next perhaps come the species of Davallia, of which two are common in the lowlands. They have very decorative finely dissected fronds, which are also more resistant than most ferns to exposure to sunlight.

A little-known fern, which is apparently rather difficult to grow, is *Pteris Dalhousiae*, first collected in Penang by Lady Dalhousie. It is not now common in Penang. The fronds are several times branched and the branches are like narrow green ribbons.

The tree-ferns are very decorative for a large garden with a shady border, and not difficult to grow if they are well sprayed in dry weather.

There are several rock ferns, particularly *Doryopteris*, which make attractive pot plants; but nearly all ferns are decorative and interesting, and anyone who studies them will find that collecting local fern plants alone would fully occupy the resources of an ordinary plant house.

Orchids.

Much has been written about local orchids, and anyone who is interested is advised to buy the complete series of issues of the *Malayan Orchid Review*. It will perhaps suffice here to give a list of the local species which are of the greatest decorative value. Over 700 species of orchids are known to occur in the Peninsula, but a large proportion of them have quite small flowers, which would be of no particular value to gardeners, though they are of considerable botanical interest, and nearly all the flowers are beautiful if one examines them with a lens. The larger-flowered species are as follows:—

Aerides odoratum.
Arachnis flos-aeris, Maingayi and *Hookeriana* (the Scorpion orchids).
Arundina, two or three species.
Bromheadia Finlaysoniana.
Calanthe veratrifolia and *rubens.*
Coelogyne, several species.
Cymbidium Finlaysonianum and *pubescens.*
Cypripedium barbatum and *niveum.*
Dendrobium crocatum, crumenatum, secundum, Farmeri, sanguinolentum, Pierardii, superbum, Dalhousieanum.
Doritis pulcherrima.
Grammatophyllum speciosum.
Habenaria carnea and *Suzannae.*
Haemaria discolor.
Phaius, two species.
Phalaenopsis violacea and *sumatrana.*
Saccolabium miniatum.
Sarcopodium, two or three species.
Spathoglottis aurea, affinis, and *plicata.*
Stauropsis gigantea.
Stauŕochilus fasciatus.
Vanda Hookeriana, and *Miss Joaquim.*

THE PRINCIPLES OF ORCHID CULTURE IN THE TROPICS *

In defining the principles on which orchid culture can be undertaken to afford the orchidist the best guidance and help, it should be stated at the outset that there are no cast-iron principles or practices on which to work, as many commercial and private growers will attain the same excellent results, but under many different modes of cultivation. The reason is of course that climatic conditions guide adaptation and the plant's new environment often varies to a remarkable degree.

In Ceylon however it can be definitely stated that climatic conditions are particularly favourable for pretty well all the tropical orchids and for many of the sub-tropical orchids also. The three climatic zones of Ceylon specified as the low-country, mid-country, and up-country enable such as require hot conditions (humid or moist), intermediate conditions (humid or moist), and cool conditions, mostly moist, to be respectively well catered for.

Further, to assist successful orchid culture, there are facilities available in the direction of fairly cheap labour with little necessity for the need of any costly equipment in the way of housing structures, the materials for such structures as is required being very cheap as is the material required for potting and upkeep of the plants, and lastly there is available by import and from local sources a range of orchids suitable to any elevation or particular climatic conditions envisaged in the three zones above mentioned.

Ceylon is a small island and for its size is remarkably well opened and accessible by means of roads, major or minor, tracks and bridle paths, and offers extremely favourable facilities for the study of the natural habits of its orchids in the jungle, and of acquiring first hand knowledge of orchid physiology. It is the object therefore of this article to ascertain some general means by which orchids, and particularly exotic orchids in the tropics, can be grown to satisfaction and to embrace the many and varied groups of orchids now in cultivation, but which only too often persistently refuse to attain this required standard. Why is it that certain orchids considered quite easy to grow in European and American countries present many difficulties under our tropical and, undoubtedly, more compatible conditions ? The first, and main principle for the potential grower is that he should understand and realise the way in which orchids grow, the method by which they obtain their nourishment and the climatic conditions under which they thrive in their native habitat. He must then

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learn how to apply the knowledge thus gained to the many types of plants assembled from many sources and probably of very varying conditions, in a composite collection in one house or garden, in one particular locality.

Orchid Physiology.

Habitat.—Orchids can be found in most parts of the world with the possible exception of the large deserts and polar regions. Some are terrestrial or land plants, the great majority are epiphytic and a very few are saprophytic. Of the hundreds of genera and thousands of species to be found, we in Ceylon possess 60 odd genera and about 160 species. The majority of orchids are tropic or sub-tropic, a small percentage only being temperate, and these are mostly terrestrials. The geographical distribution is remarkable as although widely distributed they are rarely found in abundance in any one place requiring as they do special or particular places and conditions. The Dendrobiums for instance are particularly eastern, numbering over 600 species with a distribution embracing Ceylon, India, Malaya, Japan, Australia and the Pacific Isles, and Vandas too are particularly eastern, whilst Cattleyas, Oncidiums and others are restricted entirely to the new world, Cattleyas to Central and South America, chiefly Brazil and in the Andean regions, Laelias to the maritime provinces of Mexico, Guatemala and Southern Brazil, and Oncidiums to Mexico, Central and Tropical America and the West Indies. The range of altitudes in which this latter genus can be found varies from the hot coastal regions to elevations of 12,000 feet in the Andes, and for that reason it is most desirable to know the mountain species which normally require much cooler conditions than the others. Since the genus Oncidium has a great number of species found in nature under such varying conditions a few further details might here be given. Careful observation of the distribution of the species will allow of quite a number being grown under much the same conditions. Some few would obviously thrive best in Colombo and similar low-country localities, others at mid-country environments like Peradeniya and still others at the mid to up-country elevations. Taking Oncidiums as an example, *Oncidium Cavendishianum, O. lanceanum, O. luridum* and *O. papilio* would be very useful plants to grow both under Colombo and Peradeniya conditions; *O. incurvum, O. macranthum* and *O. Phalaenopsis* are suited to Peradeniya and the mid-country; and *O. cucullatum* to up-country elevations, as this is probably one of the coolest of the Columbian orchids.

A knowledge of the locality or the native habitat of the species is therefore something of a guide to the grower and not only the particular country or countries in which the plant is found but details of the approximate latitude and elevation, the rainfall and other climatic details of the plant's habitat have to be ascertained. With this knowledge quite a large assortment and variety of plants can be successfully catered for in the general orchid collection.

Habit.—Few growers need reminding that orchids fall into two main groups, the terrestrials or ground orchids and the epiphytes, but superficially

to the beginner the groups are not always or entirely distinct in that many epiphytes can quite successfully be grown in what appear to be terrestrial conditions. The terrestrials include most of the orchids found in temperate countries and many of the largest and most handsome of the tropical orchids. The lower portion of the plant in this group forms a rhizome, from the apex of which the shoot of the following season arises, or in other words each annual shoot bends upward into the leafy shoot of the current year. Being perennial, some means of food storage is required and in many cases this takes the form of a thickened internode of the stem. It will be noted that " food storage " is mentioned and it is this character that mainly, in its cultural requirements, calls for differentiation in the treatment as compared to the epiphytic group.

Nutrition.—The epiphytes are, as you know, plants that grow upon another or some elevated support. They are found mostly upon trees or on rocks and the means by which they attach themselves to such is, in the first place, by the formation of " clinging " roots which fasten the plant to its support but do not extract nourishment and which it will be noted, *grow away from the light.* The niche or niches between the plant and its support and the network of these " clinging " roots act as small reservoirs or catchment areas for fallen leaves or other decaying and humus-forming matter. Other roots, called " absorbing " roots, branch out and penetrate into this reservoir or catchment area. Finally the true aerial roots are formed and these hang down from the plant in long festoons. It is these highly specialised roots that enable the plant to elaborate food materials from the gases and moisture of the atmosphere, and the means by which they do so is that the outer layer of cells of the aerial roots are dead and perforated, and act as a sponge to absorb water trickling over them, whilst the internal cells or tissues are green and living and they have the power of assimilating, or in other words they have the means of manufacturing from the air and from water. Most of such orchids are assisted in their quest of food by fungi, species of *Rhizoctonia,* which settle on their roots and aid them in their function of splitting air and water vapour into the requisite nutritive substances. To the initiated this illustrates the biological phenomenon of " symbiosis."

This then is, briefly, the way in which orchids grow and the method by which they obtain their nourishment and we now pass on to the climatic conditions under which the plants in their native habitat thrive

Air.—The aerophytic character of epiphytic orchids and the mode by which these plants in general obtain atmospheric nutrition through the roots or root fungi having been touched upon, the further physiological requirements embrace the plants' necessities and requirements of light, and moisture.

Light.—The influence of light on growth and activity naturally varies since some orchids are to be found only in dense shade, others in semi-shade or only mid-day shade, and others fully exposed on rocks throughout

the day. It varies with the particular plant and is therefore the particular plant's requirement in this respect. Taking our local orchids as an example which can be personally studied, the " Wanarajah Orchid " (*Anoectochilus regalis*) is a leafy terrestrial found only in leaf mould in the dense low-country forest, and in cultivation is most unsatisfactory if given conditions which depart very radically from these requirements. The " Daffodil Orchid " (*Ipsea speciosa*) on the other hand, a pseudobulbous terrestrial, requires a very open site and is generally found in open patna in grass in the mountain zone. Again these plants in cultivation need to be given conditions very similar to those in which they are found naturally. Of the epiphytes the dry zone *Vanda spathulata* is found on bushes and rocks in very open and exposed portions, whilst *V. Roxburghii* is most commonly found in the dry regions on tree trunks and branches subject to mid-day shade.

Taking the latter as an example, the significance of over-head shade from mid-day sun to this and many others similar species should be noted, for under normal cultural conditions other than these retard the plant's progress. Though difficult to account for it, where light is regulated, as in a glass house in more temperate climates, it is found that with certain species, of which *Vanda Roxburghii* might be termed one, excessive light at certain stages of the plant's growth leads to upset in the working of the chlorophyll in the leaves due to over exposure. If however the plant is not exposed for too long a time the colour will return on the resumption of shade to the house. Another point of similarity is the fact that it is always advised to erect orchid houses in a way that they are open to morning sun. Why is it that morning sun is beneficial, not only to orchids but to many other types of plants ? There is a reason of course, and it chiefly concerns moisture and the right amount of moisture in the air in combination with heat, which in some way counteracts the sun's rays, thereby preventing scorching or unduly shrivelling the plant. The plants in a structure facing east receive the full sun's rays but these are tempered by a generally lower temperature resulting from the night's radiation and heavy dews. If facing a western position the plants would be exposed to the rays of the afternoon sun chiefly at a time when the temperature of the air is at its maximum and the general amount of moisture which counteract the heat rays, has evaporated and is at a minimum. A western position therefore might, and does, suit such orchids as are particularly exposed in their native habitat to hot and dry conditions throughout most of the year, but generally speaking the majority of orchids and other plants prefer the former conditions of an eastern aspect.

Moisture.—This question of moisture in the air is therefore an important one. Certain species thrive best with a low rate of humidity whilst others require a very high rate. The difference between moisture absorbed from a normally humid atmosphere and that obtained by the plant from a direct wetting by rain, or by can or syringe under cultural conditions

needs careful study, for it is obvious that overwatering does occur very frequently. No hard and fast rule can be laid down with reference to watering for it requires practical experience to decide the point, in which a knowledge once again of the plants' habitat and requirements is desirable. In general however, orchids require a liberal supply of moisture whilst growing and the surroundings should always be kept in a reasonably moist condition either by regular syringing or by damping down the staging and floors. The material in which they are potted whether light, or on the heavy side has to be considered, as does the methods of potting, whether loosely or very firmly, for more frequent watering during the growing stage would be necessary where pot material is light, loose and porous than where the compost is more heavy and is firmly packed in.

At Peradeniya, the orchid house has two wings with a glazed roof which affords protection to such plants as it is desired to rest or to protect during the worst part of the monsoon The general principle here in watering is a simple one. Firmly potted plants such as the evergreen terrestrials are watered only when the surface of the soil becomes dry whilst the deciduous terrestrials which have a marked period of rest in which the roots are practically inactive are maintained in condition by syringing of the floor and stages during dormancy, and later when the growing stage is reached ample supplies are given by means of periodical waterings.

With epiphytic orchids a little more care is required in watering, since some of them, Dendrobiums for instance, are subject to long resting periods during which watering can be withheld and only a little syringing given, whilst with others like Aerides, on the other hand frequent watering at all periods is necessary. To the observer the reason is fairly obvious in that Dendrobiums and such like have pseudobulbs which act as a reservoir to the plant and enable it to carry on through dry spells, whilst Aerides, Vandas and their like have no such resources and must rely on daily watering for their supplies. The leathery and terete leaves of some species are an adaptation of the plants to meet dry spells by affording a reduction in transpiration and subsequent loss of moisture.

Cattleyas and Laelias in their native habitat are found in humid forests on rocks and trees mostly along the margins of rivers or ravines, and usually in shade, where they receive ample supplies of water from heavy dews and the mists that saturate the forest during the dry season. The growing season however coincides with the heavy rains and it is apparent that under cultivation these plants should never be entirely devoid of water though they too possess pseudobulbs.

A further point in regard to moisture and watering at low and mid-country elevations is that syringing of the plants during normally dry weather is best done in the morning and in the evening, with an additional syringing or damping down of benches and floors at midday, but the actual watering of the plants is best done in the late afternoon, that much at least can be generally advocated.

Application of Orchid Physiology to Orchid Culture.

With regard to the application of orchid physiology to orchid culture we in Ceylon have many natural advantages, especially bearing in mind the fact also that most tropical orchids will within reason adapt themselves to varying conditions, and the fact that the lack of any extreme range of day and night temperatures at any one place in Ceylon (if one excepts such places as Nuwara Eliya) is of great help, for orchids much dislike such variations.

Appreciating these facts, the next question is the method or form in which the different types are best cultivated. Some thrive best in pots or baskets and others on trees, but where the latter facilities are lacking pot culture is usual and is moreover often very convenient.

Pots.—There are various designs of pots and baskets available, but receptacles with perforated sides and with several drainage holes are preferred, although bamboo sections if well seasoned and of fairly large dimensions and perforated with the drainage holes as in the earthenware pot, answer the purpose equally well. Another form is afforded by cutting a longitudinal section of the bamboo joint with one side cut away slantingly, the bottom and side being well perforated and the plant fixed in with a covering of coir fibre over the potting medium and retained in position by a strand or two of copper wire.

For terrestrial orchids, pots of some kind are necessary and for certain epiphytes, *e.g.*, " Wanarajah " or any orchids which grow in marshy land or among deposits of humus, or fern roots, pots must be used. For epiphytes, the selection is a wide one since these may be grown either on suitable trees, in baskets or in pots. They really need some special provision that will admit air to circulate freely among the roots as otherwise they are liable to decay through excess of water if confined too closely. For orchids with pendulous scapes as Stanhopeas, baskets are commonly used, these being made of strips of any hard wood, usually teak, in an open crate-like arrangement.

Composts.—The potting mixture for epiphytes should consist of pieces of broken brick or such like porous material, pieces of old bark or wood, which must however be hard and seasoned and not soft and spongy, chopped up seasoned coconut husks, well leached, a small percentage of charcoal and bone chips and some sphagnum moss chopped up to some degree. This latter is not easy to obtain, being found in a limited area up-country. Growers in cooler countries make much use of peat for all orchids, but this is not obtainable in Ceylon, and a good substitute is well matured and decomposed bracken and fern roots, which are not difficult to obtain.

For terrestrial orchids a heavier compost is required and this is obtained by a mixture of good and well chopped up turfy loam, well matured leaf-mould, a small percentage of well decomposed cattle manure, broken pieces of old bark, crushed bricks, a small percentage of charcoal and a sprinkling of well steamed coarse bone meal. Though pots perforated

to the extent of those used for epiphytes are not necessary, nevertheless good drainage must be given and at least two inches of good drainage material supplied at the bottom of pot, covered with a layer of sphagnum moss on which the mixture above mentioned can be placed. Certain orchids require a heavier mixture than this, for example Thunia, which thrives better with a larger percentage of turfy loam and leaf-mould with the addition of some sand.

Potting.—In all potting operations the old soil should be carefully taken from the roots, particular care being taken however not to injure or snap off any of the roots. The plant should be set fairly high, about two inches above the rim of the pot, the base of the pseudobulbs thereby being above the soil. The mixture should then be worked closely between the roots with the fingers, hard or too firm potting not being at all necessary, and the pot filled to the brim. A top dressing is generally advisable and a layer of sphagnum moss should be laid over the top and gently pressed in, and it may be necessary to stake the plant for a time until sufficient roots are formed and obtain a hold of the compost to support itself.

After potting, care should be taken not to give too much water, and after a good initial watering, spraying only will be required for sometime, but when the plants begin to make fresh roots they may be given a more plentiful supply and they should, of course, be given a shady position whilst recovering from the potting operations. In renovating by top dressing it is usually sufficient to remove the surface material, as this in course of time is apt to become sour, but one should not penetrate to any depth. Care should be taken not to injure the roots more than can be helped and the material used will of course vary according to type of plant being dressed and it should be worked in and under the roots rather than over them. This operation is best performed when new roots are apparent or new bunds are in the early stages of development. In any operation, whether potting or top dressing, the greatest care is needed to ensure that ample drainage is afforded the plant, for faulty drainage upsets all watering and spraying methods.

Propagation.—In regard to propagation there are several methods applicable to the various types of orchids. With many ground orchids such as Arundina and Spathoglottis root division is a common method, whilst Renantheras and Vandas can be propagated by cuttings taken from the growing ends of the stems. Others such as Phalaenopsis can best be propagated from basal shoots which occur when the plants age, whilst with some species young shoots are produced at the top of the flower scape which will with care provide good material. It is wise however, as with some Dendrobiums which produce young plants on the old mature pseudobulb to apply a ball of fibre or moss to the off shoot into which the roots will attach themselves, and not to separate the off shoot until it has become well established.

Cattleyas and similar types of pseudobulbous plants are usually propagated by division of the rhizome, the latter being partially cut through at about three pseudobulbs behind the young shoot. This acts as a check to force any dormant eyes or buds behind the cut and when such are sufficiently developed the back portion can be separated and grown on as an individual plant. Propagation by seed cannot be discussed here owing to its vast scope, but though the raising of orchids from seeds has for long been shrouded in much mystery, nevertheless much information has in recent times become available and though the difficulties involved in the procedure are considerable, they are not unsurmountable even in Ceylon. The benefit or otherwise of manuring of orchids is at our present stage of orchid culture a debatable question though a weak solution of cattle manure does seem to be beneficial to many types of orchids. This however, together with hybridising and seed raising afford much future interest and scope to all concerned in orchid culture and collections, in Ceylon or elsewhere.

Miscellaneous.

BEE-KEEPING IN MALAYA

In response to an enquiry received by the Malayan Agri-Horticultural Association from a member, Mr. R. Macgregor, the Government Veterinary Surgeon, Selangor, kindly supplied the following notes, and, as they will doubtless be of interest to other readers, we reproduce them here.

In reply to your enquiry, certain officers in this Department and their friends have been investigating the possibilities of bee-keeping in this State. Although the investigation was instigated at the request of certain Malay villagers, it is quite unofficial, and as it has only recently been started, the information obtained to date is meagre.

The Malays in question keep their bees in hollow logs, split lengthwise and tied together with rotan or wire, by which they are hung from low branches or the joists of the house floor. Stands cannot be used as ants and lizards would enter thereby and rob the hive. The general method may be described as a variant of the " skep " system, that is to say the hive sends out swarms from time to time, which swarms are introduced into new hives and when sufficient of these new hives have been occupied, the parent hive is destroyed, the honey comb taken therefrom and the brood comb thrown away. The honey comb is built round and above the brood comb and must be cut off with a knife, the dividing line being quite clearly marked and easily followed.

The Malays do not catch the swarms, as they usually settle on inaccessible branches of high trees, but several empty logs are kept hanging in suitable places, and one of these is nearly always found by the swarm scouts who subsequently lead the swarm there, though of course several swarms must be lost. The operation of opening the hive, that is taking apart the two halves of the log, is carried out at night by a man who has become immunized to the stings. He takes out all the comb, but does not attempt to kill the bees, and these sometimes form an emergency swarm and occupy a new log or re-occupy the old one, though the more usual ending would be the death of all bees except the few who are received into other hives.

Wasteful as this method seems, there is much to recommend it. It involves no labour except that of lifting the honey, and occasionally the splitting and hollowing of a new log and hanging it in position. It involves no expense; thus no capital is lost should disease occur and destroy all the hives, and a fresh start can be made as soon as a wild swarm has settled in an empty log.

The honey obtained was brown in colour and not very sweet, but

was liquid enough to strain through a cloth. The wax was poor and also brown, as both honey and wax seemed to be contaminated with powdered wood. The villages were surrounded with coconut palms and some wild honey collected in a coconut estate was similarly contaminated, so we are inclined to connect it with this palm. One hive produces about two pints of honey in two months as well as the three or four swarms needed to carry on the business.

We established hives in the Animal Infirmary, Kuala Lumpur, where coconut palms are few, and there are plenty of well-kept gardens in the neighbourhood. The honey so produced was pale yellow, liquid and very sweet, and the wax white. While the actual compound had plenty of honolulu, both wax and honey were rapidly produced, but when this was cleared away the production was so slow that it barely maintained the hive. It is necessary, I think, to mention that many flowers produce a honey that, although beneficial to bees, is harmful to human beings and if it is intended to keep bees in artificial garden areas, it would be as well to consult a botanist as to this possibility. It is also important to remember that even the honey bee will scavenge if food is scarce and they should not therefore be kept near abattoirs or filthy streets.

We constructed frame hives of eighteen inches cube in size, and shaped with removable frames one inch wide and half an inch apart. We tried to fill these at first by direct transference of bees and comb but this method failed as it was impossible to transfer the queen alive. The probability is that she was killed during the process of " balling " or the rush of the guardian bees round her at the alarm. Swarms, both natural and artificial, were caught successfully on low branches and shaken down into a mosquito net bag, and then shaken into the new hives. An artificial swarm is produced by hammering on the outside of the hive until the swarm emerges. It can, I believe, be made to run straight into a new hive placed at the entrance of an old one, but we could not get a bee-tight joint between the log and our hives.

These bees would not take the old comb, fitted in the frames, but insisted on building their own new comb, and as this was never straight, it soon jammed up the frames; possibly some fault in management was the real cause of this. Nor could we get excluder sheets to work. These are sheets of zinc with holes cut sufficiently large to allow worker bees to pass but not the queen, and by their use one should ensure that parts of the hive are filled with honey comb only and no brood. Actually we found that though an occasional bee would pass the excluder, the great majority would not do so.

The bees are sufficiently docile on fine mornings to allow the hive to be opened and examined without smoke or veils or any other precaution but in the afternoon or in rainy weather they are irritable, though the sting of one or two is not unduly painful.

They seem to be very poor house guards and cleaners. Ants, spiders,

beetles, chik chaks and even hornets have been found inside the hives, and dirt is allowed to lie on the floor untouched.

I am told by Mr. H. M. Pendlebury of the Museum, Kuala Lumpur, that the bee in question is identical with the European honey bee *(apis melificatus)* but there are two other species of honey collecting bee here that have not been domesticated. The true honey bee should cross with European strains.

This is all the information that I can give your enquirer and I am afraid it is of little practical value. If, however, he is willing to try for himself, it is possible that his experiments will be more successful than ours and he may be interested to hear of the lines on which we are trying to work.

MUSHROOM CULTURE IN CANTON *

Mushroom culture is a profitable industry in Canton, China. If its culture is well understood and the climate is favourable, mushroom growing is one of the agricultural enterprises which gives a quick yield and a large profit. In view of promises of profit many Chinese have gone into the business of raising mushrooms. As rice straw is the most important material used in mushroom culture the price of rice straw in China is relatively high. In the Philippines where rice is the principal crop and the rice straw is usually left in the field to decay or sometimes burned as waste, mushroom raising could probably be carried out profitably. In mushroom culture in China one of the largest items of expense is the rice straw. In the Philippines, however, rice straw may be had at almost no cost except for the labour in cutting it and taking it from the field.

It is surprising that mushroom growing has not been developed as a business enterprise in the Philippines. The fact that edible mushrooms may be gathered from the thickets and forests in the Philippines is probably the reason that Filipinos have not taken the initiative in the industry. Also, a cause, which is also a result, is that mushrooms are not a common article of diet in the Philippines. Another reason is probably the lack of knowledge of mushroom culture among the farmers. It is the object of this paper to describe the method of raising mushrooms in Canton, China to give information on *Volvaria esculenta*, a mushroom, and its culture. It is hoped that the paper may form a useful guide for people who may wish to undertake the growing of this excellent food.

The Mushroom cultivated in Canton.

Scientific and Common Names. The mushroom which is cultivated in Canton, China is *Volvaria esculenta* Bresadola. It was described by Bresadola[1] in 1912 from a specimen (Elmer 9937) collected by A. D. E. Elmer in Dumaguete, Negros, P. I.

The English description of the mushroom, *Volvaria esculenta* Bres. is given by Brown[2] (1921).

The common name of *Volvaria esculenta* in the Cantonese language is " Cho ku " and in the Philippines this mushroom is known as *cabuti* (Tagalog), *oong* (Ilocano and Pangasinam), *opong* (Visaya), *tobo* (Bicol), *payong-payong* (Pampango).

This species of edible mushroom is probably indigenous to Kwangtung Province, China. It is extensively cultivated in this region. That it grows wild in many parts of the Philippines shows that it is also probably native in that country or was introduced there very early.

[1]Bresadola, J. 1912. Basidiomycetes Philippineses. Serie I. Hedwigia 51: 306—326. Literature cited p. 309.

[2]Brown, William H. 1921. Minor products of Philippine forests. P. I. Bureau of Forestry Bulletin 22. Literature cited in 8: 126—130.

* A. N. BENEMERITO, *Lingnan University, Canton, China.* *The Philippine Agriculturist*, January, 1936.

Climatic Requirements of Volvaria esculenta. The raising of mushrooms in Canton begins in the month of March or as soon as it is warm enough to start the culture out of door. The production is carried on until the end of September or until the weather becomes too cold to allow culture in the open.

According to observations, the quantity of mushrooms produced is influenced by the amount of rainfall, the duration and intensity of sunshine, and temperature. When there is heavy rainfall during the day, the quantity of mushrooms gathered the following day is small, and when the intensity of sunshine is too great the yield of mushrooms is also low. When the day is cloudy and warm the yield of mushroom is high.

Under Canton conditions the yield of mushrooms is low during March and April when the temperature is still low. In May when the temperature becomes higher than that in March and April the production increases. During June and July the yield for the year is highest and then it gradually decreases in August and September, when the temperature begins to go down.

In the Philippines where the climate is warm almost the whole year round conditions would seem to be more favourable for the culture of mushroom than in Canton. Taking climatic conditions into consideration together with the abundance of rice straw and the commercial value of the product, there seems to be no reason why mushroom growing should not be carried on extensively in the Philippine Islands.

The Medium for Mushrooms in Canton.

In the European method of growing mushrooms horse manure is used as a medium. In Canton, rice straw is practically the only medium used. Rice straw is used for growing the spawn, for making the beds out of doors and also for covering the beds after they are seeded.

In Canton when one goes into the raising of mushrooms, rice straw is the chief material to secure after a suitable piece of land on which to prepare the mushroom beds has been selected. Rice straw is often secured ahead of time and in order to reduce the cost of this material it is usually purchased during the rice-harvest time in July and October when the price is low. In the Canton region, the price of rice straw is from forty cents (Canton currency) to over one dollar for every 100 catties (133 pounds), depending upon the time of the year when it is bought.

In the Philippines, experiments are said to be under way to test the use of abacá and banana waste for mushroom beds. In commercial mushroom growing the use of abacá waste may be profitable in the abacá-growing districts. In other regions in the Philippines perhaps rice straw will be found not only easy to obtain but also economical to use in mushroom beds.

In southern China the quantity of straw required by a mow (approximately 1/6 acre) of land devoted to mushroom culture is about 300 taams (39,900 pounds). If the price of a taam of straw is 40 cents (Canton currency), the cost of the straw required in a mow of land is $120 (Canton

currency), if the straw is purchased at rice-harvest time. If the straw is bought after the harvesting season the cost is much higher.

In Kwangtung Province, it is a common practice, before the mushroom growing-season comes, to keep rice straw in piles on elevated ground in the home yard or on a high place in the field. The straw is piled in a conical stack with the top well covered so as to keep the rain from wetting the interior of the pile.

The Mushroom Spawn.

At the end of the mushroom-growing season the spawn for the following year, consisting of portions of old mushroom beds, is placed under shelter to protect the fungus from perishing in the very low temperature which prevails in the winter. The spawn may be preserved by placing a thick cover of rice straw over it. If a greenhouse is available, it has been found wise to have the bed of spawn in it so as to keep the fungus alive so that there will be material ready for use when the mushroom-growing time comes in spring.

The quantity of spawn needed to seed a mow of land varies from 12 to 30 taams, depending upon the thickness of planting the spawn in the beds. Under favourable conditions, the more spawn used, the larger the yield will be. As the quantity of spawn is very limited during the early part of the growing season, the tendency of the grower is to spread the spawn over a large area. In the second spawning more spawn is used in a given area of land because at this time there is usually an abundance of spawn and its price is lower than at the first planting.

In southern China the price of spawn varies from $4 to $15 (Canton currency) a taam (133 pounds). During the early part of the season, when there is but a limited supply of spawn the price is $15 a taam. As the season advances, however, the price may go down as low as $4 a taam or less. Because of the cost of spawn, it is the common practice in southern China to begin raising the mushrooms in a small piece of land and gradually to increase the size of the land as the supply of spawn increases.

According to the figures given above the cost of spawn required to seed a mow of land in Canton is from $120 to $180. During the early part of the season when the spawn sells at $15 a taam the total cost of spawn is $180. At this time 12 taams of spawn are used for each mow of land. Later in the season when spawn sells at $4 a taam, 30 taams are used in a mow of land. At this rate the total cost of spawn needed is $120.

The Site for Mushroom Beds.

In Canton the site best suited for mushroom growing is near an irrigation system, a stream, river or where an abundance of water may be secured. Although too much water is injurious to the growing of mushrooms, without water its culture cannot be accomplished.

In the Canton region, mushrooms are grown mostly in the lowlands where there is an abundance of water throughout the season. Although

the tide reaches the mushroom-growing regions, the water is not salty. In the absence of rain the water is carried into the field by means of a wooden pumping device. In most cases, the level of the field is very much below the level of the water during the high tide. The field, however, is protected by a dike and this dike is provided with inlets and outlets. If water is needed, the inlet is opened during high tide and if water is not needed, the outlet is opened during low tide.

Tools and Equipment.

The tools and equipment required in mushroom culture are few. A hoe and a shovel are used in the preparation of the beds; a wooden vessel fitted with a bamboo handle for watering the mushroom beds; a wooden pumping device for conducting water to the sides of the beds; and a straw basket for the gathering of mushrooms and taking them to market.

Preparation of the Mushroom Beds and Spawning.

The field is plowed and harrowed thoroughly to level the ground and destroy the weeds. The beds are made two and a half feet wide by any length. Usually, they are from 20 to 25 feet long. A path two feet wide is left between the beds. The beds are raised to about one-half of a foot high so that the water will easily drain off on rainy days.

At one end of the row of beds, a ditch about two feet wide and a foot deep is dug and the water is allowed to flow into it to facilitate watering the beds.

In the spring when the temperature rises to 20° to 25°C. the culture of mushrooms begins. In spawning a layer of rice straw about three inches or more in thickness, which had been softened by soaking in water, is spread lengthwise on the surface of the bed. This layer is trodden over by one man while another man pours water over it. A layer of spawn is then spread at the edges of the layer of straw. The process is repeated until six layers of straw alternating with spawn have been spread one on top of the other. After spreading a layer of spawn along the edges of the bed a layer of straw is spread over the spawn. A man treads on the layer of straw while another man pours water over it. Finally, a cover of straw is placed on the top of the bed. The straw used as cover is tied into small bundles before it is laid on the bed. Then an abundance of water is poured on the whole bed.

The cover, which is made of straw tied into small bundles is left on top of the bed for a week or so. Then the bundles are removed and soaked in water. After soaking, the bundles are untied and the straw is spread smoothly over the top of the bed forming a rounded top. An abundance of water is sprinkled on the bed.

Care of the Beds.

After spawning there is practically no care given to the beds except watering once a day when there is no rain. Watering is done late in the

afternoon. In the absence of an irrigation system, water is carried from a well near by or from a pond.

The Crop.

In the Canton region, there are practically seven months in a year when mushrooms are cultivated. During these seven months three crops are raised. Each crop requires from sixty to seventy days from spawning to harvest.

Sixteen to twenty days after spawning, mushrooms appear and a crop may be gathered. The mushrooms are gathered usually early in the morning and are sent to the market. Those that are left in the morning or are not large enough are gathered in the afternoon.

From a piece of land under the writer's observation, having an area of three-fifths of a mow, the quantity of mushrooms gathered each day varied from fifteen to thirty catties. With this yield a mow of land may produce twenty-five to fifty catties of mushrooms a day. If a crop lasts forty days, the total yield of one crop is 1,000 to 2,000 catties of fresh mushrooms. If there are three crops of mushrooms a year, the total yield from a mow of land is from 3,000 to 6,000 catties. Under the most adverse conditions, there may be at least 2,000 catties of fresh mushrooms produced from a mow of land.

As stated in the beginning of this paper the quantity of mushrooms produced depends upon weather conditions. When there is a heavy rainfall during the day, the quantity of mushrooms gathered the following day is small and when the intensity of sunshine is too great the production is also low. When the day is cloudy and the temperature is favourable the yield is high.

During the spring when there may be a cold breeze the beds are covered with additional straw cover to protect the young mushrooms. As soon as the danger from cold winds is over the additional straw cover is removed.

In the early part of the season when mushrooms are scarce, there is a great demand for them although the price is high. As the season advances, there is a gradual increase of supply which may become so abundant that the price may reach a very low mark. In Canton, mushroom growers generally supply hotels and restaurants with mushrooms. If the supply is more than the demand the rest of the crop is dried in the sun and sold as dry mushrooms. In the villages where the market is far away the growers find it advantageous to dry the mushrooms and keep them in this condition until the price improves. (Dried mushrooms are imported from China into the Philippines and sell for around seven pesos a kilogram).

The price of fresh mushrooms varies from forty cents or less to over a dollar a catty, depending upon the supply. If the yield of a mow of land is 2,000 catties and the selling price of a catty is forty cents, it may be seen that the total income from the mushrooms produced is $800.

Cost of Production of Mushrooms.

For the information of those who may be interested in mushroom growing the following data on cost of production based on Canton conditions are given:

Cost of Production of a Mow of Land (1/6 acre). It has been estimated that a mow of land requires 300 taams of rice straw. At a cost of 40 cents a taam the total cost of the rice straw needed for a mow is $120. For spawn, it is estimated that 12 taams are required to seed a mow of land. At the rate of $10 a taam the total cost of spawn is $120. For labour, a mow of land requires at least one man to take care of it. Under conditions in Canton the man receives a wage of $30 a month. For the seven months of the mushroom-growing season the total cost of labour is $210. The rent of land is estimated at $25. The miscellaneous expenses are estimated at $100. From these figures it may be seen that the total amount invested, excluding interest, is $575.

Income. It has been estimated that the yield of a mow of land is 2,000 catties of fresh mushrooms, the usual price is 40 cents a catty. At the estimated yield, the income from land would be $800 and the total expenses, $575 which would leave a net income of $225.

Remarks. From these estimates, it may be seen that mushroom culture is a profitable agricultural enterprise in the Canton region. In fact it is considered one of the most profitable.

Summary.

1. Mushroom culture is a profitable industry in Canton, China. The mushroom cultivated is *Volvaria esculenta* Bres. This species is widely distributed in the Philippines. In the Cantonese language this mushroom is known as " Cho ku " and in the Philippines it is known under the dialect names *cabuti* (Tagalog), *oong* (Ilocano and Pangasinan), *ojong* (Visayan), *tobo* (Bicol), *payong-payong* (Pampango).

The mushroom growing season in Canton begins in March and ends in September. The highest yield is obtained during June and July when the temperature is high. The yield of mushrooms is influenced by rainfall, duration and intensity of sunshine and temperature.

Rice straw is practically the only material used for preparing the medium of the mushroom in Southern China. A mow of land for mushroom beds (approximately 1/6 acre) requires about 300 taams (39,000 pounds) of rice straw. If purchased at rice-harvesting season a taam of rice straw costs 40 cents (Canton currency). If rice straw is secured later the price is much higher than at rice harvesting time when it is abundant.

During the winter season the spawn of *Volvaria esculenta* in Canton is kept well protected from the effects of very low temperatures. The spawn required for seeding a mow of land varies from 12 to 30 taams. The cost of the spawn varies from $4 to $15 (Canton currency) a taam, depending upon the supply.

In the Canton region mushrooms are raised in the lowlands where there is an abundance of water for watering the beds throughout the season.

The mushroom beds are usually two and one-half feet by 20 to 25 feet with a path two feet wide between them. The beds are raised one-half of a foot high.

The tools needed in mushroom culture are few and simple.

The preparation of the beds for seeding with the spawn, the spawning and the care of the beds are described in the paper.

Three crops are harvested during the mushroom-growing season. A crop requires 60 to 70 days to grow. The first crop of mushrooms may be harvested 16 to 20 days after spawning.

The yield of a mow of land in a year varies from 3,000 to 6,000 catties and the net profit from the crop may be approximately $225 (Canton currency).

Selangor Gardening Society.

Quarterly Notes

At the Annual General Meeting of the Selangor Gardening Society held in December, 1935, the following officers were elected for the year:— *President*, Mr. E. D. Butler, *Hon. Treasurer*, Mr. A. Arbuthnott, *Hon. Secretary*, Mr. B. A. Lowe (*address*: *Agricultural Department, Kuala Lumpur*), *Committee*: Mrs. Winson, Mrs. Miller, The Hon'ble Dr. H. A. Tempany, C.B.E., Messrs. Eu Kee Eng, Chew Sze Foong, Colomb and Lambourne.

Visit to Serdang.

The February meeting of the Society was held in the fruit nursery at the Central Experiment Station, Serdang, where Mr. Lambourne gave a very interesting lecture on the propagation of fruit-trees as done on a commercial scale in this country. Methods of budding and grafting, marcotting and layering and the modern method of propagation by means of etiolated shoots were demonstrated to a very interested audience. Mr. Lambourne showed many unusual fruit-trees to the members present, and certain superior varieties of limes and papayas attracted particular attention. The Society is very grateful to Mr. Lambourne for his interesting lecture and demonstration, and to the Adviser on Agriculture for permission to visit the Serdang Agricultural Station.

Flower Show.

The annual flower show organized by the Society was held at the Race Course, Kuala Lumpur, on Saturday afternoon 21st March, 1936 and attracted a large number of horticultural enthusiasts, including the British Resident (the Hon'ble Mr. T. S. Adams), who greatly admired the wealth of beautiful flowers and plants that were on view. Last year, unfortunately, the show had to be cancelled as the majority of the interested people were on leave. Its revival this year was heartily welcomed by the many horticulturists in Selangor and this was made strikingly apparent by the large number of exhibitors which equalled, if not exceeded, the previous show's figures, while the quality of the exhibits was of a much higher standard.

The Society is anxious to enrol new members and with increased support hopes to hold two shows a year in future.

Lake Gardens Exhibit.

In addition to the seven groups on view there was also a magnificent exhibit of foliage plants staged by the Department of Agriculture from the Lake Gardens. It was noted that they had some very good specimens of *Adiantum Farleyense* which is getting more scarce every year in this country. A much admired exhibit was the bourgainvillea named " Mrs. Louis Wathen " displayed by Mr. Choo Kia Peng. There was very keen

competition in the foliage section which was won by Mrs. Winson with a beautifully arranged group, while Mrs. Arbuthnott's display of stephanotis in the creeper section was of outstanding merit. Competition was also strong amongst the orchids and the honours were carried off by Mrs. Mungo Park and Mr. Thurstan. Mr. Eu Kee Eng exhibited a fine group of dendrobiums which were the subject of much admiration. In the cut flower section Mrs. Barbour won first prize with an excellent strelitzia which is easily cultivated and should be seen more in local gardens, while in the same class Mrs. E. D. Butler gained a premier award for a collection of cut flowers, particularly noticeable being her display of kuperanthus. Mrs. Butler also showed a few flowers of the crimson calliandra which grows so well up Maxwell Hill, but is uncommon in the plains.

A new introduction to the country was exhibited by Mr. Lowe named Malvaviscus which was imported by him from Peradeniya Gardens, Ceylon, where it makes a striking bedding plant.

The Prize Winners.

The prize winners were as follows:

Flowering plant in bloom: 1, S. C. Colomb; 2, B. A. Lowe.

Flowering creeper in bloom: 1, Mrs. Arbuthnott; 2, Mrs. W. J. Wright.

Flowering shrub in bloom: 1, Mrs. Winson; 2, Mrs. Winson.

Collection of flowering plants: 1, Choo Kia Peng; 2, E. D. Butler.

Terrestrial orchid: 1, E. D. Butler; 2, Eu Kee Eng.

Cattleya orchid: 1, Mrs. Mungo Park; 2, C. R. Thurstan.

Epiphytal orchid: 1, C. R. Thurstan; 2, Mrs. Mungo Park.

Fern (one variety): 1, E. D. Butler; 2, Mrs. W. J. Wright.

Fern (any variety): The Hon'ble Mr. T. S. Adams; 2, E. D. Butler.

Flowering Begonias: 1, Mrs. Arbuthnott; 2, Mrs. W. J. Wright.

Foliage plants: 1, Mrs. Winson; 2, Mrs. Wright; highly commended, E. D. Butler.

Collection of cut flowers (excluding Cannas), 1, Mrs. E. D. Butler; 2, S. C. Colomb.

Vase of cut flowers (excluding Cannas): 1, Mrs. R. A. Barbour; 2, Mrs. Winson.

Collection of cut cannas: 1, A. R. Westrop.

Flowering plant (from another country or jungle): 1, B. A. Lowe.

Flowers grown at Hill Stations: 1, C. Grondhout.

Lecture By Mr. R. E. Holttum.

The April meeting of the Society was held in Mr. Mungo Park's house and, appropriately enough, the subject of the talk was "Orchids." It appears to be usual for Mr. Holttum to be greeted by an extremely wet afternoon when he visits Kuala Lumpur and this was no exception. Consequently the attendance at the meeting was rather poor, but those who faced the rain were rewarded by a talk in which many interesting facts about orchids and their characteristics were related by Mr. Holttum. The

talk was simple enough to be understood by everybody and yet even the orchid enthusiasts learned many interesting new facts about this curious but very beautiful group of plants. Some very fine plants were exhibited, and a Brasso-Cattleya, belonging to Mr. Mungo Park, with a total of seven flowers deserves particular mention. Seldom does one see so fine a plant except in the houses of professional growers or at shows in Europe. The thanks of the Society are due once again to Mr. Holttum for his talk and to Mr. Mungo Park for his kindness in inviting the Society to hold the meeting at his house.

Miscellaneous Notes.

Members of the Selangor Gardening Society are entitled to receive copies of the *M.A.H.A. Magazine* free. Any members who do not receive their copies are asked to write to the Editor of the Magazine or to the Secretary of the Gardening Society.

As the Society is affiliated to the Royal Horticultural Society, two free passes for meetings and shows of the latter Society are available for members who may be in Europe. These passes are sent to the Malayan Information Agency, 57 Charing Cross Road, London, S.W. 1 where members may apply for them. Those doing so are requested to return them immediately after use to the Agency in order that they may be available for other members of our Society who wish to use them. It may be mentioned that these passes entitle the holders to visit the Trial Grounds of the Royal Horticultural Society at Wisley.

B. A. L.

THE M.A.H.A. MAGAZINE

(The Official Organ of the Malayan Agri-Horticultural Association and of the Selangor Gardening Society).

Vol. VI. JULY, 1936. No. 3.

MESSAGE TO *THE M. A. H. A. MAGAZINE*

FROM

THE HON'BLE DR. H. A. TEMPANY, C.B.E.,
Director of Agriculture, S.S., and Adviser on Agriculture, M.S.
Vice-President, The Malayan Agri-Horticultural Association.

I have been asked to write a message to the Malayan Agri-Horticultural Association Magazine on the eve of my departure from Malaya and I have complied with this request with great pleasure. It has been my privilege to be closely associated with the work of the Association throughout the time that I have occupied the post of Head of the Department of Agriculture in this country; I am deeply impressed with the value of its work and I am convinced that in it Malaya possesses an asset of great value.

The Association fulfils the important functions of a central body responsible for the organisation of agricultural exhibitions and shows; the Agricultural Show movement is now firmly established and for this the Association is largely responsible; its annual exhibition in Kuala Lumpur may be regarded as the culminating point of the large number of district shows held in various parts of Malaya throughout the year, and as the result of its operation great progress has been made in defining aims and ensuring continuity.

It is generally conceded that agricultural shows are of great value in stimulating effort and in assisting progress, but it is far less generally appreciated that if such efforts are to have their full effect there must be an underlying plan of campaign and a strict definition of aims. Without them, too often they tend to lose their value.

It is all too easy to organise shows which consist of heterogeneous collections of produce without any real connection or correlation with the branches of production which they are intended to represent. Of late years the policy of the Association, in so far as agricultural exhibits are concerned, has been designed to ensure that in certain important classes there shall be a direct correlation between the exhibits themselves and the conditions under which they are produced and that exhibitors are really showing something which is a commercial product and not merely a show sample; in this connection particular mention must be made of the Malayan Rice and Rubber Competitions which follow the process of production right down to the individual smallholder-producer.

In other directions the efforts of the Association are of importance. This Magazine furnishes a valuable link between the various members of the Association and those of the growing number of affiliated bodies. By means of it members are kept in touch with the efforts in progress throughout the country, while it contains much interesting information of a specialised character and many valuable papers. The Trade Sections at the Annual

DR H A TEMPANY, C B E

Exhibition in Kuala Lumpur provide an important stimulus to trade in the Malay States, whilst amongst the minor activities of the Association must be mentioned the Malayan Christmas Hamper Scheme.

The Department of Agriculture has co-operated very closely with the Association in its work. Efforts to improve the agriculture of the smallholder constitute a very important part of the work of the Department and in them the holding of District and Central Agricultural Shows should take a permanent place. The existence of a central organisation such as the Association provides has greatly facilitated departmental efforts on these lines and it is with pleasure that I record the very happy relationships which have always existed between the Association and the Department. They may be regarded as mutually necessary to one another.

In particular I would like to pay a tribute to the work of the President, Mr. F. W. Douglas, with whom I have worked in close accord during the time that I have been in this country. I consider that both the Association and the country owe to Mr. Douglas a very considerable debt for his unselfish and indefatigable efforts.

I trust that for many years to come the Association will continue to fulfil the important functions which it has hitherto discharged with such conspicuous success.

H. A. TEMPANY,
Director of Agriculture, S.S. and
Adviser on Agriculture, Malay States.

KUALA LUMPUR,
20th May, 1936.

THE
M.A.H.A. MAGAZINE
JULY, 1936.

EDITORIAL.

With the departure in May of Dr. H. A. Tempany, C.B.E., Director of Agriculture, Straits Settlements, and Adviser on Agriculture, Malay States, the Malayan Agri-Horticultural Association lost one of its staunchest supporters. Dr. Tempany has retired from Malaya, but has been appointed to be Assistant Adviser on Agriculture to the Secretary of State for the Colonies and we offer him our sincere congratulations on this appointment.

The Association owes a considerable debt of gratitude to Dr. Tempany for the whole-hearted manner in which he has given it his support and, through him, the support of the Department of Agriculture during the past few years which have probably constituted the Association's most difficult period since its inception in 1922.

We can write from personal experience of the very practical help given by Dr. Tempany, since, in his capacity as *ex officio* Vice-President of the Association, he was always willing to devote time to discussing the Association's affairs and to give assistance with the organization of the annual Malayan Exhibitions, and we were, therefore, in close contact with him.

Two of the most important developments of the Malayan Exhibition are due to the initiative of Dr. Tempany. We refer to the All-Malayan Padi Competition and the All-Malayan Rubber Small-holders' Competition. The former competition was inaugurated in 1934 directly as the outcome of a scheme drawn up by Dr. Tempany and organized with the co-operation of the Department of Agriculture and the Government Administration. The competition has been described in detail in this Magazine on several occasions, and, briefly, its object is to obtain inter-State competition with exhibits of padi which have already gained awards at District Agricultural and Padi Shows as representing the best padi of each particular padi-growing territory. The All-Malayan Rubber Competition is on similar lines, designed to encourage the small-holder to prepare better quality rubber.

Both competitions, therefore, directly assist in the improvement of the production by the small-holder of the two major crops of Malaya, and will remain as a record of Dr. Tempany's valuable services to the Association.

We feel sure that all members of the Association will join us in wishing Dr. Tempany all success in his new appointment.

Thirteenth Malayan Exhibition.

Once again we approach the August Bank Holidays and with them the annual Malayan Exhibition which is now a regular feature of Malayan life.

Strenuous efforts have been made to overcome the dust nuisance which has been such a source of annoyance each year. A plank ceiling has been provided in the main building to reduce the heat problem, and more space is allotted for resting places for footsore visitors.

We have so often in the past dilated upon the usefulness of and need for this annual Show that we hesitate to put our readers' patience to the test by further comment. Agriculture and trade are obviously the life-stream of Malaya, and, to mix our metaphors, the Malayan Exhibition is the shop-window of both.

Poultry Feeding.

Through the kindness of the Adviser on Agriculture we are able to reprint in this number an article on poultry feeding published recently in *The Malayan Agricultural Journal.*

This article is of particular importance as recording the results of what were, we believe, the first experiments of their kind in Malaya. We cannot, perhaps, do better than quote certain of the editorial comments which accompanied the article in its original form.

> " It is to be noted that the work was carried out in conjunction with training in general agriculture. Facilities for the conduct of research work are frequently provided in scholastic institutions and are of considerable value in that they impress upon students the necessity of careful observation and recording. In the present instance, the conduct of poultry investigations at the School of Agriculture carries with it the additional advantage of emphasising the scope which exists in Malaya for the extension of poultry husbandry to bridge the gap of about one million dollars annually between local production and the total consumption of poultry and eggs.
>
> We have known a number of poultry-breeders in this country in the past who have relied almost entirely on imported poultry-food mixtures, and who claimed that their birds thrived on such foods. Foods mixed by commercial firms of repute are based on a knowledge of the nutritional requirements of poultry, and although the cost of imported foods in Malaya is high, they may be expected to possess advantages over many of the locally-devised rations, which not infrequently are ill-balanced in one respect or another. It is in respect of this matter of costs relative to efficiency that carefully-planned investigations with local rations assume a considerable degree of importance.
>
> The experiments here recorded indicate that weight increase in young chicks can be considerably accelerated and made to approximate more closely to typical breed weights than was the case with rations previously advocated by this Department.

The author commences with a standard of weight increase of Rhode Island Reds from hatching to twelve weeks of age, which is accepted by poultry-breeders in temperate climates. As it was found impossible to attain this standard in Malaya with the rations usually adopted in the past, four new rations were drawn up and tested on chicks of this breed.

Too great reliance cannot be placed on the results of feeding with Ration C, as only one group of Rhode Islands was fed on this ration; Ration B gave better results than A, while Ration D was better than either A or B.

The fact that this work was conducted in conjunction with the school training prevented different batches of chicks being subjected to the experimental conditions simultaneously, and, therefore, rigid proof is not forthcoming. The probability is, however, that the results will be found to hold good in general practice.

The results indicate the desirability of including a comparatively high proportion of dried skim milk in the ration, and thus confirm, under Malayan conditions, results which have been obtained elsewhere. The author estimates that the cost of feeding a bird to 16 weeks, by which time it should weigh 3 lbs., would be about 80 cents. This may appear high, but it is cheaper than importing new pure-bred birds from abroad, and the quality of any surplus birds which were used for table purposes would be far superior to that of village-produced birds bought in the local markets.

The experiments were concerned only with the first twelve weeks of the life of the bird; the next step would appear to be to investigate rations suitable for poultry from this age until they come into lay or are ready for the table. It is to be hoped that, in spite of the limited facilities at the School, it may be found possible to pursue this subject in the near future."

We have no doubt that there must be several poultry-breeders in Malaya who are rearing poultry on a reasonably large scale who have been carrying out their own experiments as to what are the most satisfactory economic poultry rations. Unfortunately, so often the results of such experiments are not recorded and are ultimately forgotten when the poultry-breeder retires from the country or sells up his flock. We would, therefore, appeal to any of our readers who are interested in this subject, and who have obtained satisfactory results, to place them on record through the medium of this journal.

The Singapore Gardening Society. We include in this number a brief note regarding the formation of the Singapore Gardening Society in June. We are glad to learn that this new Society proposes affiliating itself to the Malayan Agri-Horticultural Association and will adopt this Magazine as its official organ.

In our first Editorial in 1933, upon the revival of *The M.A.H.A. Magazine*, we expressed the hope that the Magazine would be the means of linking up the various societies which are in existence. This hope has not been fully realized and we again extend an invitation to any societies with similar interests, but without a publication of their own, to consider affiliation with the Malayan Agri-Horticultural Association and the adoption of this Magazine as their official journal.

Another aspect of the wider use of *The M.A.H.A. Magazine* is the possibility of obtaining a greater variety of articles from our readers. We are fortunate in having a few regular contributors who have kept us supplied with articles of a high standard, but it is obviously unfair to expect them to continue such good deeds indefinitely, and they themselves suggest that more variety is advisable and articles of possibly a less academic nature desirable.

We appeal, therefore, to our readers for their assistance, either with articles or with letters in our correspondence columns.

Horticulture.

THE PITCHER-PLANTS OF MALAYA

BY

R. E. HOLTTUM, M.A., F.L.S.,

Director of Gardens, S.S.

The pitcher plants known to botanists by the name of *Nepenthes* are a characteristic feature of the plant life of Malaya. They are very abundant in many places in the lowlands, and in the mountains there are some peculiar local species. Their pitchers, by which they are enabled to catch and digest small animals, are familiar to nearly everyone, and they have long been cultivated in Europe for the curiosity and beauty of their form. In Malaya they are rarely grown, and might receive more attention from local gardeners. Some notes on cultivation will be found at the end of this article.

The genus Nepenthes forms a very isolated group in the plant kingdom. There is an American genus Sarracenia which has pitchers of a similar kind, but from many other points of view Nepenthes and Sarracenia are quite different, and it is improbable that they are closely related. Within the genus Nepenthes itself the species are very closely related, so that their distinction is often a matter of difficulty or doubt, and there has apparently been a good deal of natural hybridisation. The latest account of the group, by Dr. B. H. Danser (in the *Bulletin du Jardin Botanique de Buitenzorg*, Series 3, Vol. IX pp. 249-438) admits 65 species. One is found in Madagascar, one in the Seychelles, one in Ceylon, one in the Khasya hills, and the rest are all found in the area bounded by Sumatra on the west, South China on the north, Java and the north of Queensland on the south, and eastwards they extend to New Guinea and beyond as far as New Caledonia and the Isle of Pines. The area with the largest number of species is Borneo, with 28; Sumatra has 18, and the Malay Peninsula 12. Many of these species are mountain plants, restricted either to single mountains or to those of one of the land masses. The small number of widely distributed species are lowland plants, or at least can exist in the lowland country.

The appearance of pitcher plants is well known. They are climbers, the leaves (which may or may not have a distinct stalk) consisting of a stiff blade, more or less oblong in shape, prolonged into a tendril with which the plant grasps any twigs upon which it can climb, and the tendril is often again prolonged into a pitcher. The pitcher is thus not a flower, but is part of a leaf. Some species rarely bear pitchers on their climbing stems. In such cases (one of them being *N. ampullaria*, the commonest Malayan species) the pitchers are found on the ground in groups, usually borne as side branches on the long trailing stems. Plants of all species

bear these ground-pitchers in their young stages, before they have developed a climbing stem. The form of the pitchers on the climbing stems is usually quite different from that of the ground pitchers, and a knowledge of both is necessary for the proper understanding of the species. It is only the pitchers of the climbing stems which develop the characteristic shape, attenuated below; the ground pitchers are rounded below. Some of the Bornean species have large and most curiously shaped pitchers of a very elaborate nature.

It is a curious fact that Nepenthes plants are not typically true forest plants, though they are only found in the Malayan region, where high forest is the natural vegetation. Nepenthes plants need a stronger light than that of the shady depths of the forest. They grow in more open places: in secondary forest, in rather open swamp forest, on the sea cliffs, and on high mountain ridges. They vary in their tolerance of shade. All require a wet soil, at least in their growing season, but they are very tough plants, and will stand temporarily considerable drying.

How the Pitcher-trap Works.

Round the opening of the pitcher is a finely grooved smooth rim, called the *peristome*, usually toothed along its lower edge; when it is best developed it forms a funnel-shaped entrance to the pitcher. Along its margin are glands which secrete a sugary juice which is very attractive to insects. On one side the peristome is produced upwards more or less to form a neck, and to this neck is joined a more or less rounded lid, which usually stands horizontally over the mouth of the pitcher. The under side of the lid is also usually glandular, the round (often conspicuous) glands producing a sticky liquid. On the outside of the pitcher, towards its attachment to the leaf, are two longitudinal ridges or wings, usually more or less fringed with long hairs. The inside of the pitcher is glandular over a part or all of its surface; the glands in this case secrete not a sugary nectar but a digestive fluid. When an insect, attracted by the glands, alights on the peristome, it easily falls into the pitcher, and can only return with great difficulty, owing to the slippery nature of the inner pitcher walls, and the smooth toothed funnel edge of the peristome. It usually falls into the water in the pitcher, where it is drowned and digested. When sufficiently digested, the substance of the insect's body is absorbed by the glands. In this way the plant adds to its stock of nitrogen, and is doubtless thereby assisted to flourish on poor soils. In spite of this elaborate mechanism to ensure the drowning and digestion of insects, there are a number of small animals of various kinds which live and flourish in the pitchers of Nepenthes plants. In the Journal of the Malayan Branch, Royal Asiatic Society Vol. 6, part 3, pp. 1-27, there is an interesting series of papers by C. Dover and others on the fauna of Nepenthes pitchers. In the pitcher fluids have been found living larvae of eleven species of mosquitos; also young tadpoles (though there is no evidence that these can

come to maturity in the pitchers), a mite and numerous protozoa. All these organisms must possess powers of resisting the digestive ferments contained in the pitchers. The pitchers of *N. ampullaria*, which have their lids turned back so that rain water can enter, appear to harbour more of such organisms than pitchers which are protected to some extent by horizontal lids from the entrance of rain. Besides these aquatic animals, larvae of a small moth, and a small spider, have been found constantly living in the pitchers of *N. gracilis*. The spider makes its home beneath the peristome round the opening of the pitcher, finding a convenient retreat just beneath the glands which attract insects to the pitchers. Its prey come unsuspecting right to the edge of its hiding place.

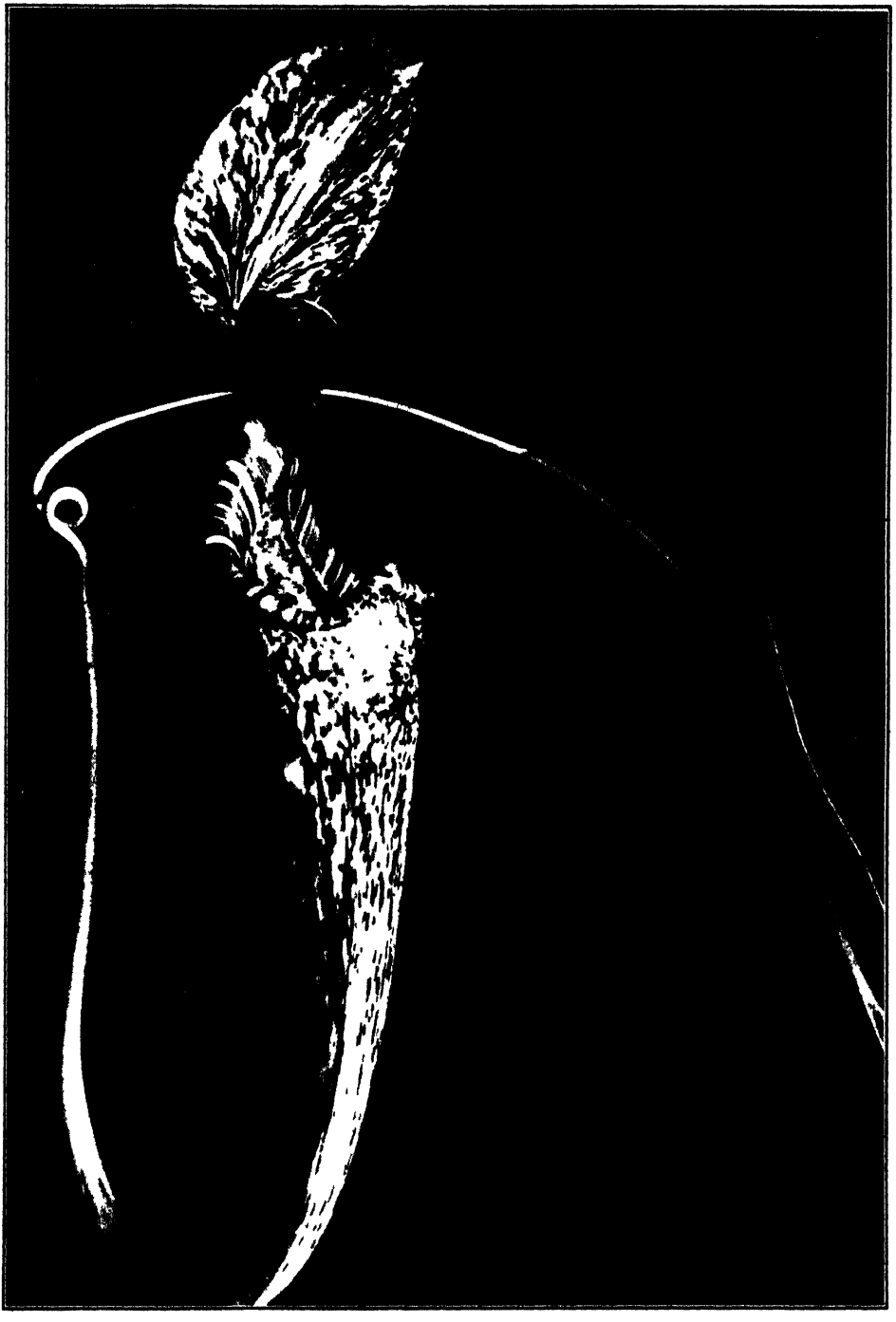
Flowers and Seeds.

The flowers of Nepenthes plants are small and usually dull green or reddish in colour, borne in long inflorescences at the ends of climbing shoots. Each inflorescence bears either male or female flowers only. The two kinds of flowers are very similar in appearance, as the stamens of the male flowers are united together into a rounded mass which is approximately the same shape and size as the group or stigmas in the female flowers. Whether the male and female flowers are usually borne on the same plant or not is not certainly known; observations on this point would be of great interest.

The flowers have a heavy rather unpleasant smell, which is stated to attract flies, which carry the pollen from the male to the female flowers. Further observation on the agents of pollination in our common species is needed. It is certain that pollination regularly occurs, as ripe fruits of Nepenthes are almost invariably full of good seeds. The fruits are dry capsules about an inch or less long, and each contains numerous seeds. The seeds are minute; the seed coat is prolonged at each end into a very narrow flat wing, which makes the seeds very light and easily transported by wind. When sown on moist soil the seeds germinate freely, producing two small green cotyledons very much like any other small seedlings. The next leaves after the cotyledons form minute pitchers, each larger than the last, and so the plant gradually developes a rosette, which later gives rise to climbing stems.

Notes on the Local Species.

N. ampullaria In Singapore at least, this is the commonest species. It may be found in almost any patch of secondary jungle; for example, round the border of the MacRitchie Reservoir. As already remarked, it is characterized by usually bearing pitchers only in groups on the ground. The pitchers are almost globular in shape, usually mottled with red and green; the peristome is broad and flat, and is not toothed at its lower edge; the lid is narrow and usually turned backwards. The pitchers vary much in size, and may reach about 4 inches in height; usually they are smaller than this. In some patches of jungle they are exceedingly abundant. The climbing stems are stout, and the leaves are set upon them without any



A Pitcher from the Climbing Stem of *Nepenthes Rafflesiana.*

Nepenthes ampullaria: Male Flowers.

distinct stalks, by which character they may be distinguished from those of *N. Rafflesiana*, which are always distinctly stalked.

N. gracilis This is probably the next species in order of abundance. It is a much more slender plant than *N. ampullaria*. The leaves are unstalked, narrower and thinner than those of the preceding species, and the pitchers small and elongated. The pitchers are not often found in rosettes on the ground, except in very young plants; those of the climbing stems are up to about 4 or 5 inches long, and usually not more than one inch wide at the widest part. The peristome is nothing more than a very narrow rim stiffening the mouth of the pitcher. The lid is well developed and rounded, standing horizontally. This species grows everywhere in secondary jungle along with *N. ampullaria*.

N. Rafflesiana This is the third common local species. It is a much finer plant than either of the preceding. It was first discovered in Singapore by Raffles in 1819. Young plants, and sometimes side shoots of old plants, bear rosettes of pitchers on the ground. These may be very large and handsome; though they are somewhat the same shape as those of *N. ampullaria* they may easily be distinguished by the curved strongly-toothed peristome, more coarsely ribbed. Climbing stems bear broad long-stalked leaves, and pitchers of the typical form, the base widening gradually in an upward curve from the end of the long leaf-tendril pitcher. The peristome is broad, rather coarsely ribbed and toothed, curving outwards over the edge of the pitcher, and prolonged into a narrow erect neck; the lid is large and rounded and is not turned backwards. This species occurs in secondary jungle along with the other two, but less abundantly. It seems on the whole to prefer more exposed places, and is to be found along with *resam* fern and shrubs on the cliffs near "Labrador" and at Tanah Merah on the south coast of Singapore, growing almost down to the sandy beach.

Where *N. Rafflesiana* and *N. ampullaria* are growing side by side, one may sometimes find a plant intermediate between these two species. This has been called *N. Hookeriana*, and is almost certainly a hybrid. I do not think it is abundant, but close search is needed to distinguish it, as at a glance its ground pitchers resemble closely those of *N. ampullaria*. Its leaves are slightly stalked. The ground pitchers may be distinguished from those of *N. ampullaria* by the peristome, which is more nearly like that of *N. Rafflesiana*, and is distinctly toothed at its lower edge; the lid however is narrow (almost intermediate between the two species) and is turned upwards or backwards, though not so strongly as in *N. ampullaria*. The pitchers of the climbing stems resemble those of *N. Rafflesiana* but are smaller, and the lid narrower and erect. Fuller investigation of this species and its relative abundance is needed.

N. mirabilis (also known as *N. phyllamphora*) occurs locally at Penang and other places in Malaya, but it is not abundant. It is the species of

widest distribution, occurring in South China, and also as far east as New Guinea. Its pitchers somewhat resemble those of *N. gracilis*, but have a broader peristome; the leaves are broad and thin.

N. trichocarpa allied to *N. gracilis*, occurs in Singapore, but is not common. The only other locality from which it is known is Sibolga in Sumatra.

N. albomarginata is abundant in Penang, in the open parts of forest on the hill. It has long narrow dark green leaves, and pitchers much of the same form as those of *N. gracilis*. The pitchers may however be distinguished at once by the narrow white border below the mouth. They are often of a rather deep purple colour.

N. sanguinea appears to be the commonest species at Fraser's Hill, where it is found on the rather open cleared valley sides in moist places, often among ferns. The pitchers of its climbing stems are of approximately the same form as those of *N. Rafflesiana* but the peristome is finer, not toothed, and not so broad, and the neck not so pronounced. The lid is covered with deep rimmed glands all over its lower surface. The pitchers are usually of a rosy colour. This species needs further investigation. It appears to hybridize with other mountain species, and careful study of many plants in the field is required.

N. Macfarlanei is another mountain species only known in the Malay peninsula. It grows at Pine-tree Hill, near Fraser's Hill, and also at Cameron's Highlands, and may in typical cases be distinguished by the long stiff hairs which cover the under side of the lid of the pitcher. It appears to hybridize with *N. sanguinea* and other species and puzzling intermediate forms occur. A further mountain species, also confined to the Peninsula, is *N. gracillima*, which typically has slender small pale green or white pitchers; they may be spotted with red. It has been found at Pine-tree Hill and at the Gap, and appears to hybridize with *N. Macfarlanei*.

It will be apparent from the foregoing remarks that there is still information wanting about nearly all the Malayan species, especially the mountain ones. The casual collection of odd pitchers or other parts of plants will not help to advance our knowledge, as it is unlikely that any more distinct new species remain to be discovered. What is required is careful study of many living plants in the field, and of all their parts, stems, leaves, pitchers and flowers. Such study will help to give us a proper understanding of the relationships of the many intermediate forms which have been found. Artificial hybridization, if it could be carried out, would also yield most valuable evidence. The relation of insects and of other small animals to the various species of Nepenthes also needs further study.

Cultivation.

It is curious that locally cultivated Nepenthes plants are rarely as fine as those seen in European hot-houses and we evidently need to study

them more. The plants are usually grown in hanging baskets to display their pitchers to the best advantage. A light open soil with plenty of leaf mould is desirable, and the plants must be kept in a moist place, or frequently watered, as the roots grow near the surface, and drying will check their development. The plants may exist for a long time in fairly dry soil, but they will not grow. The easiest way to secure plants for cultivation is to dig up small plants or rooted short branches of old plants. Put them into pots or baskets and keep them in a thoroughly moist shady place until a new growth is established; they may then be hung up in a more open place if frequently watered.

In European hot-houses the plants are freely propagated from cuttings, but for some reason this process is apparently not so easy in Singapore; probably the conditions for rooting are rather different, and may be discovered by further experiment. Some species require a rather bright light to induce pitcher formation, while others will produce pitchers in a shady place. When a plant produces a long shoot, this should be checked by cutting off the tip; the production of pitchers is sometimes stimulated by so doing, and the plant will remain in a bushy shape. The mountain species will exist in cultivation in the lowlands, but they do not thrive.

Growers of Nepenthes plants should beware of mosquito larvae. The pitchers of *N. ampullaria* are very liable to breed mosquitoes, but *N. Rafflesiana*, a much finer species, rarely has them.

AVENUE TREES (*Continued*)

BY

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Since the publication of the last paper of this series, it has been decided to extend the scope of the subject and to include lesser known species which might be introduced into general horticultural practice and which might be used as avenue trees.

Terminalia Catappa (Kĕtapang, Indian Almond.)

This species is commonly known as the " Indian Almond " and belongs to Combretaceae. It is a Malayan species and generally grows on sandy seacoasts. In such situations under cultivation it forms a most attractive tree. In fact, together with the Rain Tree and Casuarina it seems to be able to grow in a soil medium consisting largely of sea sand. It is a handsome tree when well grown, with a distinctive habit of growth. It can best be likened to a series of umbrellas raised one above the other. This is due to its special mode of growth whereby it grows to a certain height and then produces a number of lateral growths more or less at right angles to the main stem and in a complete circle around it. This type of growth is produced in successive seasons the result being a spreading tree, the branches of which are arranged in tiers each separated by a length of main trunk. It is an exceedingly useful shade tree beside the sea, its large handsome leaves forming a heavy shade. It grows to a height of about 50 feet. Its flowers are not showy but it produces a quantity of fruits which are about the size of a plum. These contain a kernel which is edible and rather like an almond. There are only two things to its discredit, one is that twice a year it drops all its leaves at one time, though it often turns a fine red before doing so, and makes rather a mess; and the other is that it is liable to be badly " shot-holed " by insects. However, these are really small matters compared with the ornamental value of the tree. For avenue purposes near to the sea it would be extremely useful. In combination with *Casuarina equisetifolia* it should form a most attractive avenue.

Sandoricum indicum (Sentol.)

This tree is a native of Malaya and belongs to the family *Meliaceae*. It is quite an ornamental tree though its flowers are inconspicuous. It grows into a bushy tree up to 60 feet and upwards in height with a fine trunk and a handsome head of foliage. The leaves are trifoliate; that is, the leaf is divided into three separate leaflets after the manner of " shamrock " or clover, though on a much larger scale. These leaves are glossy on the upper surface and give the tree a handsome appearance. The inconspicuous flowers are succeeded by a crop of yellow globular fruits, which contain

seeds covered with soft flesh, very like the Mangosteen. These fruits are edible but are rather acid. The tree is widely distributed in Malaya and is commonly found in villages and by roadsides. Good specimens of this tree are very attractive and its use for avenue purposes should not be overlooked. The combination of fine light-coloured trunk, handsome dark shining leaves and yellow fruits, makes a fine picture. Planting distances for this species should be not less than 60 feet, between the plants and 30 feet from the road, for to obtain the best effect from the avenue, the trees should not be allowed to grow into each other. This tree often grows side by side with *Dracontomelon mangiferum*, another compound-leaved tree which is very attractive at the period of leaf change, the old leaves turning a beautiful red-brown colour. A combined avenue of these two species should be effective and would be distinctly uncommon. However, it is recommended only for parks and such-like large areas where the full value of the trees can be obtained.

Sandoricum nervosum (Kechapi)

This species is closely related to the Sentol but is generally (at any rate in Penang), a larger tree and more imposing. It seems to grow to large proportions beside streams and in such positions is a very fine tree. The fruits are a golden yellow and are produced in abundance. It is recommended for avenue work in conjunction with some other large growing species such as *Swietenia macrophylla*, in which the contrast between the pale green and very dark green foliage would be very striking.

Cratoxylon ligustrinum (Mĕmpat.)

This is a Malayan tree of lowland woods and is conspicuous for its beautiful slender red brown trunk from which the old bark peels in large flakes at intervals. The tree is a tall one, a good specimen having a height of 60 feet, with a rather smallish bushy crown of foliage at the top. This leaves a long expanse of the attractive red brown trunk mentioned above. The leaves are on the small side, with the result that the tree gives a general impression of lightness. The small pink flowers appear when the new leafy growth is complete. The specimens seen are all in somewhat shady damp positions which probably has the effect of giving them greater height than might be the case if planted in the open. This species should be a particularly attractive one for park avenues and could be used in conjunction with its relative *C. cochinchinense* (mentioned below) either for a single avenue or for the rear rank of a double avenue, with a small species growing in the front row. It is not a rapid grower and the wood is, therefore, on the hard side and thus fairly resistant to white ant attack. Planting distances for this tree should be 40 feet between plants which is close planting for tall trees, and 30 feet from the road in order to obtain the full value of the ornamental trunk and the display of flowers.

This species is called *C. polyanthum* in Ridley's Flora, but *C. ligustrinum* is an older name.

Cratoxylon cochinchinense.

This is a very similar tree to the above in regard to general habit and flowering but is quite distinct in the matter of bark and period of flowering; *i.e.* the bark is a rough fissured one and does not peel off, while the flowers are produced when the tree is bare at the time of leaf-change, giving a most charming effect like that of many spring-flowering trees in temperate climates. Otherwise the trees agree more or less in general aspect except that, on the whole, this species is slightly larger and has a rather more spreading crown. The flowers are of a paler shade of pink than those of the preceding species. It is recommended for interplanting with *C. polyanthum* for avenue purposes in which case planting distances between plants should be increased to 50 feet. This species is called *C. formosum* in Ridley's Flora.

Both these species are unusual and little known as subjects for horticultural purposes.

Chickrassia tabularis.

A good specimen of this fine species in the Waterfall Gardens, Penang, has only recently been assigned its correct genus. For many years it has been considered as a species of *Melia* but it now found to belong to an allied genus *Chickrassia* of the same family, *Meliaceae*. The species is widely distributed in Southern Asia. In India, it is a timber tree and it is obvious from the Penang specimen that it is a good type for this purpose as it produces a straight trunk which bears at the top a bushy crown of foliage. At all times it is an ornamental tree, with its fine straight trunk, elegant compound leaves and beautifully shaped head of foliage. At its flowering period it is a fine sight, producing an abundance of small white flowers on spikes about 6 inches in length. It remains in flower for two or three weeks. It is a fine tree for use on a large scale and would make a very fine back row to a double avenue. Alternatively, it could be used by itself and the full value of its straight trunk be obtained. Planting distances for this tree should be not less than 60 feet between plants and 20 feet from the road. It is propagated by seed. The Malayan specimens of Chickrassia differ in some respects from Indian ones, and it is possible that they represent a distinct species, which should have a new name.

Gnetum Gnemon.

This is a Malayan tree belonging to a family (Gnetaceae) which are neither true flowering plants nor conifers. It is a fruit tree and produces the fruits known as "Buah maninjau." For avenue purposes it has one characteristic which is not shared by any ornamental flowering species so far met with, in Malaya. This is, its habit of growth, which is close and generally columnar in shape, rather like the Lombardy Poplar and some of the columnar Conifers. For this reason, it is probably the only species in Malaya which could be used to produce an avenue of columnar shaped trees and therefore, it deserves special consideration. Such an avenue would

be entirely different in effect from the type produced by our other trees and would be worth doing. However, some slight difficulties might arise as an occasional tree is somewhat more spreading in habit and might seriously mar the production of a perfect avenue. However, this propensity should be detected fairly early and a tree of the more characteristic habit could be substituted. The production of the columnar effect is due to the upward growth of the side branches which is quite different from the ordinary outward or more or less horizontal growth of practically all our other trees. Its flowers and fruits are not particularly attractive though they are interesting botanically. Its value for avenue purposes lies in its close habit and its columnar form. It is a slow growing tree and takes a long time to reach a height of 40 feet but its value for avenues of this type cannot be overestimated and the years of waiting would be well worth while. It is propagated by seed. Planting distances should be 25 to 30 feet which would allow for each specimen to be seen at its full value. For a long avenue these distances should be increased to 40 feet. It is included in the large trees as owing to the hardness of its wood if given proper attention it is not likely to suffer white ant attacks, in which case it may develop above the 40 feet line.

The following species of the large type are " possibles " for avenue work, but rather from the point of view of fine trunks and general shape, than for flower displays.

Canarium commune (Buah Kĕnari. Java Almond.)

A large handsome species introduced from the Moluccas which produces very fine, curiously knobbled buttressed trunks. It makes a very fine shady avenue of which the trunks are the most interesting feature. Propagation is by seed.

Hymenaea courbaril.

A tropical South American timber species commonly known as the " Locust Tree." It is a member of Leguminosae and produces a very fine smooth-barked trunk which bears at a good height a magnificent bushy crown of foliage. Its flowers are whitish but not very conspicuous. Propagation is by seed.

Millettia atropurpurea (Tulang Daeng.)

A Malayan species which bears a handsome head of close dark foliage. The flowers are a dark purplish colour, but are not particularly interesting. The close bushy dark crown of foliage is the really attractive part of this tree from an ornamental point of view. This species is named *Adinobotrys atropurpureus* in Ridley's Flora.

Cinnamomum parthenoxylum.

This Malayan Cinnamon grows to a great height and produces an impressive rough-barked trunk with a very spreading bushy head of foliage. The flowers are small and whitish in colour are produced on branched spikes

and are sweetly scented. In its younger stages the full benefit of the scent is obtainable while as a fully grown tree it is very impressive.

Ficus spp.

Malaya is very rich in species of *Ficus* and many of them are trees of considerable size. Generally speaking they are not very suitable for avenue purposes and are better used as specimen trees, for which purpose such species as *F. benjamina* (Waringin), *F. microstoma,* and *F. retusa* are eminently suited. However, such tall growing species as *F. irregularis,* an introduction from the Celebes, and *F. variegata,* a tall growing species of the lowland forests, are suitable for avenue purposes, where beauty of form and foliage are aimed at. The figs (in which the flowers are produced) generally are more curious than ornamental. *F. variegata* produces a very fine smooth-barked trunk buttressed at the base, and could very well be given a place in a mixed avenue where fine trunks are required to form the chief attraction.

F. religiosa, the Peepal Tree, has been mentioned under Roadside Trees (see *M.A.H.A. Magazine,* Vol. V, p. 7). It is a good avenue tree.

This does not exhaust the list of large flowering trees, but is sufficient to show that there are plenty of species to select from, for use as avenue trees in parks, etc. where trees of large dimensions can be shown to advantage.

In selecting these lesser-known large trees care has been taken to mention only those species which have been tried out in open positions. There are probably several Malayan jungle trees which might be thought suitable for avenue work, but it must be borne in mind that these trees when planted in open positions do not always retain their jungle habit, for example *Mesua ferrea* is rather a tall straggling tree in the jungle while in the open it produces a beautifully shaped tree with branches to the ground. Again *Podocarpus imbricatus* in the jungle is a fine tree, with a tall straight trunk and large crown of foliage. The same species, when grown in the open, produces a symmetrical tree of less than half the height with branches down to the ground. Therefore, until other species of jungle trees have been tried out in open situations an opinion as to their value for avenue work cannot be given. However, from the good results already obtained, further research in this direction would appear to be profitable.

(To be continued).

NARCISSUS FLOWERS IN MALAYA

Singapore.

Mr. T. M. Kinnear of the Civil Aerodrome, Singapore, has recently been successful in flowering some Narcissus plants at his house in Jalan Eunos. With the exception of Mr. Flippance's note in this Magazine Vol. V No. 1, we do not know of any published record of the flowering of Narcissus in Malaya; the details of Mr. Kinnear's success are, therefore, of particular interest.

Twelve bulbs of a Polyanthus Narcissus named "Soleil" were received on November 4th, 1935. They had already begun to shoot, some to an extent of one inch, and were at once planted. They were put into pots of good garden soil, and placed on a bench on the north side of the house where they had good light all day, but little direct sun. The pots also were somewhat shaded by ferns, pots of which were alternated with the Narcissus pots. The Narcissus plants were watered regularly in the evening with cooled water from the refrigerator. Mr. Kinnear suggests that keeping the roots cool by shading and by cool water in the evening is an important factor for success.

By December 30th the plants had all grown very strongly, each producing several full grown leaves of perfectly normal appearance. Four plants out of the dozen had two flower-stalks, the rest one. The longest flower stalks was just over two feet, and had ten buds on it, nearly all of which had opened, displaying small rich yellow flowers of delightful fragrance. The buds on another stalk were just opening, and several more were almost ready. We may thus say that from planting to flowering has taken just about two months.

At the same time as the Polyanthus bulbs, Mr. Kinnear received yellow daffodils of the varieties "Emperor" and "King Alfred." These showed no signs of sprouting when they arrived; one of each was planted, and the rest kept loose in a box, but none had showed any signs of sprouting by the end of December. This is in agreement with trials at Fraser's Hill and Penang. It appears that single-flowered doffodils cannot be flowered in Malaya.

Fraser's Hill.

Narcissus plants have successfully been flowered at a nursery at Fraser's Hill. The successful types are:

1. a Polyanthus Narcissus with yellow petals and an orange corona. This flowers in 6 to 8 weeks from planting.
2. a variety of Narcissus Poetaz, with creamy white petals and a yellow corona. This has a finer fragrance than the Polyanthus type. It flowers about 4 months from planting.

Bulbs of both the above have been rested at Fraser's Hill and have flowered a second time.

Narcissus Poetaz is a hybrid between *N. tazetta* (the original

Polyanthus) and the white single-flowered *N. poeticus*. It has several flowers of the *poeticus* type, on each main stalk; the flowers are larger than those of *tazetta*, on longer individual stalks.

The flowers of these Malayan-grown Narcissi are not so fine as those produced in Europe, but they are very pleasing, and the fragrance is most refreshing after the rather heavy odours of tropical flowers.

R. E. HOLTTUM.

Penang Hill.

In order to test the possibilities of growing bulbs on Penang Hill, various genera have been tried out. Amongst these, certain types of *Narcissus* have been included and the results of trials to date are set out below.

Three consignments of bulbs have been imported as follows:— December, 1933, Consignment A; February, 1935, Consignment B; October, 1935, Consignment C.

CONSIGNMENT A. This consignment included the following:—

12 *Narcissus polyanthus* var. "Grand Monarque." The results obtained from these bulbs have been mentioned in an earlier number of this Magazine*. On the whole they can be said to have been reasonably successful as six bulbs produced good flower spikes. The period of time between potting and flowering was approximately five months. Percentage of flowering was 50 per cent.

CONSIGNMENT B. This consignment included the following:—

100 Narcissus—Section "Large Trumpet" in ten varieties.
24 ,, —"Poetaz" hybrids in three varieties.

The bulbs were given the same general treatment as for consignment A. For a time it appeared that some success might be obtained, for most of the bulbs produced good roots (a *most* important point) before foliage was allowed to develop. However, the leaves did not make such good progress as the roots, with the result that no flower spikes were obtained.

These bulbs were potted on 2nd February, 1935. By the 9th Sepember, 1935 it became obvious that results were unsatisfactory and accordingly this experiment is recorded as a failure.

CONSIGNMENT C. This consignment included the following *Narcissus polyanthus* varieties:—

50 Grand Monarque; 10 Snowflake; 10 Early Double Roman; 10 Gloriosa; 10 Soleil d'Or; 10 Grand Primo. Total 100 bulbs.

The bulbs were received on the 7th October, 1935, and were potted immediately and given the general treatment accorded to previous consignments. Rooting progress was satisfactory and, after one month, the more advanced plants were removed to a half-shady position, with a view to elongation of foliage and the production of flower spikes. The remainder were removed at intervals of a week, until they were all in position.

* *M.A.H.A. Magazine*, Vol. V, p. 24.

Good growth and flowers were obtained from only three of these varieties, as follows:—

Early Double Roman—produced good leaves—first flower spikes opened on 31st December. 1935. Succeeded by the blooming of five other bulbs.

Soleil d'Or—produced rather short leaves—first spike opened 12th February, 1936. Succeeded by the blooming of four other bulbs.

Grand Monarque—produced good leaves—first spike opened on 16th February, 1936. Succeeded by the blooming of fourteen other bulbs.

The variety " Snowflake " produced only two spikes of flowers. This variety is an improved form of a very old established variety, " Paper—White," which is a great favourite for the early-spring market in England and better results had been hoped for.

The varieties " Gloriosa " and " Grand Primo " produced short leaves but did not flower and must be recorded as failures.

Percentages of flowering of consignment C were:—

Early Double Roman	**60 per cent.**	**Soleil d'Or**	**50 per cent.**
Grand Monarque	**32 per cent.**	**Snowflake**	**20 per cent.**
Gloriosa	**Nil.**	**Grand Primo**	**Nil.**

Average: 27 per cent.

GENERAL CONCLUSIONS.

Of the *Narcissus* types tested to date, only *polyanthus* varieties have given success and these only to a limited extent.

Of the six *polyanthus* varieties tried, three have been flowered reasonably well and it may be worth while experimenting with further varieties. In regard to these three varieties " Early Double Roman ", " Soleil d'Or " and " Grand Monarque ", it is interesting to note that the first named produced flowers six weeks before the other two varieties which bloomed together.

It is found that on Penang Hill results are uncertain and, except as a matter of interest, *Narcissus* does not appear to be a genus which is likely either to become acclimatized or to be a valuable addition to garden plants grown there.

It is considered that conditions on Penang Hill are too damp for proper development, which results in many cases either of rotting of the bulbs or else in stunted growth.

From the limited success obtained it would appear that considerably more success is likely to be obtained at higher altitudes (Penang Hill garden is 2,500 feet) provided general conditions are dryer. It is strongly recommended that *Narcissus polyanthus* varieties should be given a trial at Cameron Highlands.

F. FLIPPANCE.

NEW OR INTERESTING ORNAMENTAL PLANTS

BY

R. E. HOLTTUM, M.A., F.L.S.,
Director of Gardens, S.S.

Malvaviscus Conzatii. Large-flowered Turk's Cap.

The small-flowered *Malvaviscus arboreus* has been known in Malayan gardens for many years, and deserves to be more frequently grown, as it produces its brightly coloured flowers quite freely. It is much surpassed, however, by the plant here described, which is a new arrival in Malaya.

Malvaviscus (meaning " sticky mallow ") is a genus of the family Malvaceae, to which belong Hibiscus and the Hollyhock. There are a number of species, all shrubby plants, native from Mexico southwards in tropical America. The habit and leaves are much like those of Hibiscus, and the flowers would be also if they were fully opened. One may describe the flowers as like Hibiscus flowers which are almost closed. The genus has a later name (which is sometimes found in gardening literature) *Achania*, meaning " not opening."

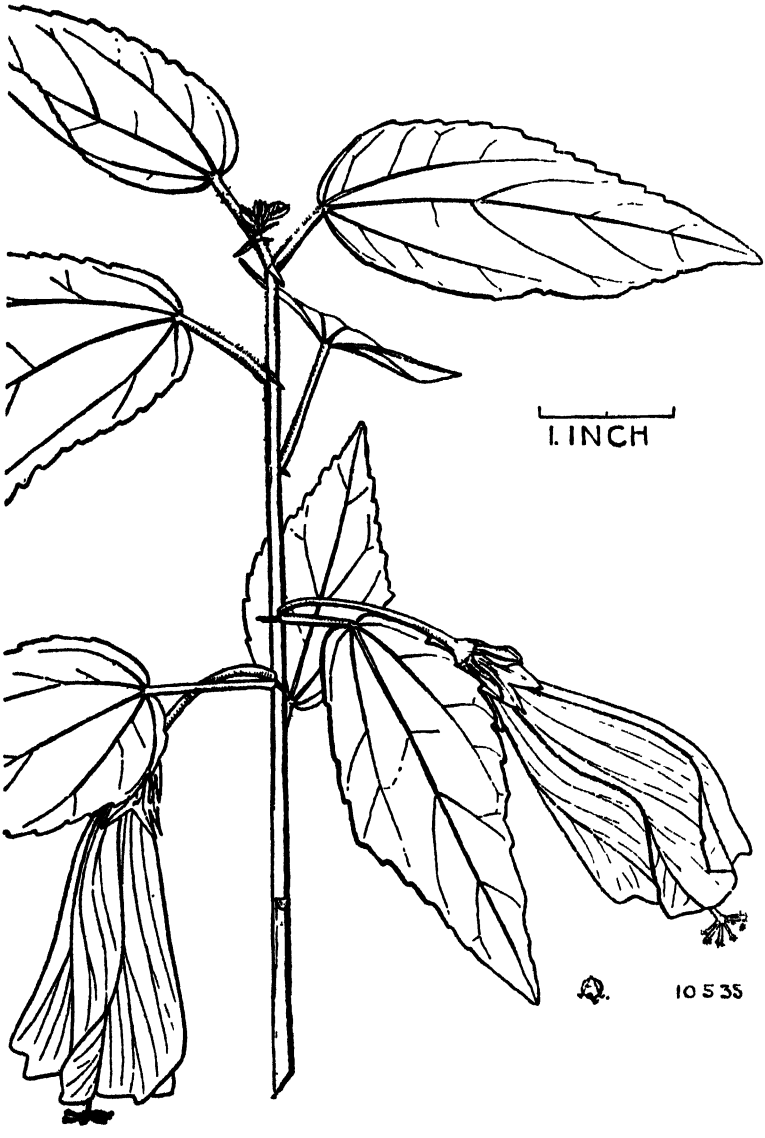
M. Conzatii has leaves very like the common Hibiscus but narrower, especially at the base, and more finely toothed. The flowers are a fine bright red, over two inches long, with the stigmas protruding from the tip. They are usually somewhat pendulous. The shrub grows vigorously and flowers freely, and it is easily propagated from cuttings. Like the common Hibiscus, it does not seem to produce seeds in Malaya.

We owe the introduction of this species to two sources. Mr. B. A. Lowe, of Kuala Lumpur, brought plants from the Royal Botanic Garden at Peradeniya, to which the species was introduced from Madras under the name *Achania Leschenaultii*, a name I cannot trace. It is likely that the introduction to India was made through Kew. At any rate its cultivation in the East is of quite recent origin. It has apparently been known longer in the West Indies, as might be expected, but its absence from Bailey's " Cyclopaedia " indicates that even in the New World it is a fairly new garden plant. The name *M. Conzatii* is taken from Standley's account of the genus in *Contributions from the U.S. National Herbarium*, 1926. Mr. Nauen also informs me that it is cultivated in Bermuda under that name.

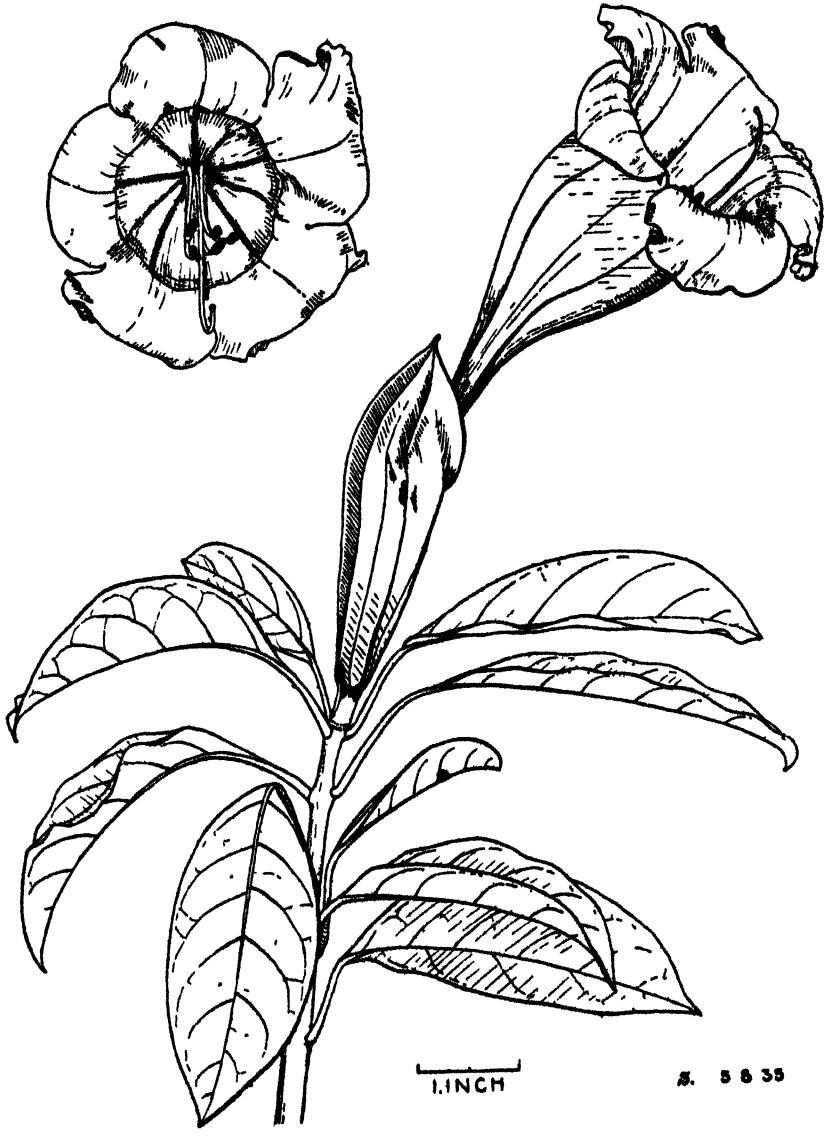
Dr. Herklots of Hongkong also sent plants to Singapore last December under the name *Malvaviscus grandiflorus*. That name however is said by Standley to apply to a species with much smaller flowers.

Solandra grandiflora. Solander's Trumpet-flower.

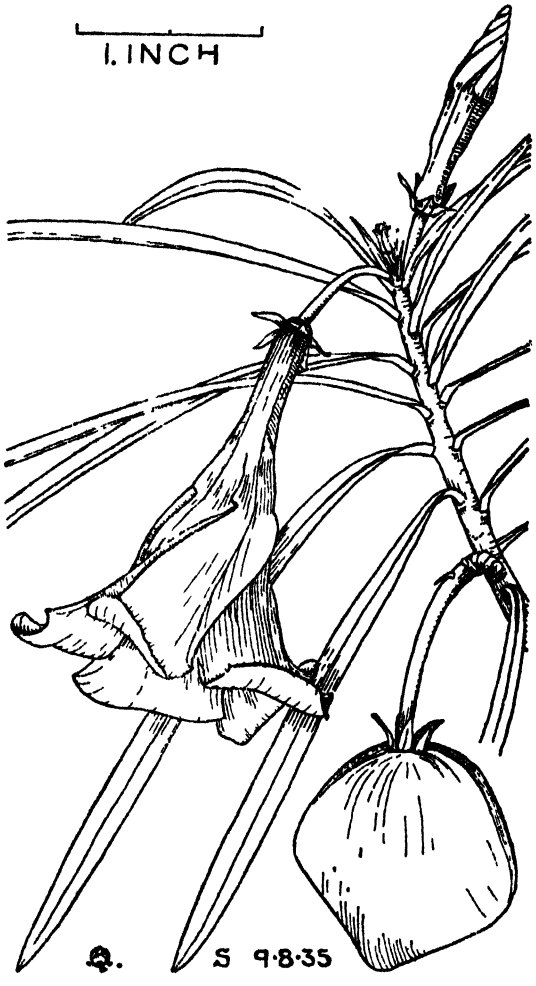
This fine climber, native of the West Indies, was named in honour of Dr. D. C. Solander, a Swedish naturalist of the 18th century, pupil of Linnaeus and intimate friend and fellow-traveller of Sir Joseph Banks (whose name has recently come to general notice in the film " The Mutiny on the Bounty ").



Malvaviscus Conzatii.
(DRAWING BY DR. G. A. C. HERKLOTS)



Solandra grandiflora.
(DRAWING BY DR. G. A. C. HERKLOTS)



Thevetia peruviana.
(DRAWING BY DR. G. A. C. HERKLOTS)

Solandra belongs to the family Solanaceae (the potato family). It is a stout woody climber, with long pendulous leafy shoots, the leaves simple and entire. The flowers are trumpet-shaped and of very large size; the accompanying drawing by Dr. Herklots of Hong Kong will give a better idea of them than verbal description. They are creamy white when they open, with dark purplish veins, becoming gradually yellower. The anthers are purple. The flowers are fragrant at night. They are rather similar in form to those of Datura (Thorn-apple, Kĕchubong), which genus is considered to be most nearly related to Solandra; the two differ chiefly in their fruits.

In Jamaica, according to Solander's own observations, the plants grow out of old trees and in the fissures of rocks. The two plants in the Singapore Botanic Garden are growing on old oil palms, rooting among the persistent leaf bases of the palms, and clothing the palm trunk from the crown of leaves downwards with a mass of pendulous branches. The flowers seem to be produced at all times of the year but are rarely very abundant. The plant can be propagated from cuttings. It does not fruit in Singapore.

Thevetia peruviana (*Yellow Oleander*) and its varieties

Thevetia peruviana (also known as *T. neriifolia*) is a plant which has been so long cultivated in the East that it has almost the appearance of a native. It belongs to the same family as the oleander, and its narrow leaves are very similar (Nerium is the name of the true oleander, hence *neriifolia*), and this resemblance has resulted in the popular name "yellow oleander." The flowers, however, are more near to those of Allamanda, though smaller; they are a pretty yellow colour and delicately scented. After the flowers, come round slightly angled fruits. The seeds are freely produced and are usually the easiest means of propagation. All parts of the plant contain a milky juice which is highly poisonous; the seeds also are very poisonous, though the purified oil expressed from them is said to be harmless.

Thevetia is native from Mexico to Brazil. It makes a pretty, ornamental bush or small tree, especially in sandy places, and is well known. Less well known however are the colour varieties, two of which are cultivated in Singapore.

The white Thevetia has long been in cultivation in the Botanic Gardens, and its origin is unknown. It has a somewhat more open habit of branching than the yellow-flowered type and is perhaps not so free flowering. It produces seeds, but whether these breed true we have at present no record. Like the other varieties, it may be grown from cuttings.

The variety with apricot-coloured flowers was introduced by seed from Formosa a few years ago. It has a closer habit than the type, and flowers quite freely. It breeds true from seeds and is easily propagated in this way. The colour of the flowers is very pretty and it should be better known. At the Botanic Gardens it is in a rather heavy soil, and it would probably grow and flower better in sandy soil in a more open place.

HERBACEOUS BORDERS *

Herbaceous Borders, as understood by gardeners in Europe, are of course impossible out here but a very fair imitation, suitable for this country, is possible. (Probably a Malayan perennial border would be a more fitting designation).

The first thing, as I see it, is to have a continuous display of colour, without the perpetual digging up and replanting, necessary with beds of such ephemeral, though beautiful, exotic (exotic in this country) plants as Zinnias, Balsams, Cleome, etc. The idea is to make use of the common and long-lasting flowering plants to be found in this country.

Before we mention the plants, let us for a moment have a look at the soil in the proposed border. The best type of border, and the most beautiful is a long continuous bed, about 3 or 4 feet wide, along the side of a drive or lawn, the longer the better, and as this is to be semi-permanent, it should be dug as deep as possible, and all the available old garden rubbish, ashes, manure, old leaves, etc. should be mixed in with the soil. In Malaya, deterioration of soil is so rapid, that it is scarcely possible to incorporate too much organic matter with the soil, whether it is sandy or clay.

And now for the plants. The first of them is a very common one called *Angelonia salicariifolia*, or sometimes "Malayan Snapdragon." There are white and blue varieties, but the white is far superior and more showy. This grows to about 1½ or 2 feet, and forms nice healthy clumps. It should be planted along the back of the border about 1½ feet apart to allow for growth.

In front, *Coreopsis grandiflora*, the perennial " coreopsis." This is a low-growing plant, growing in tufts, about 8 inches high, and throwing up masses of bright yellow, daisy-like flowers, on long stems, for months on end. This should be planted about a foot apart in the front of the border.

Now for the centre of the border. Let me mention here that individually, these flowers may not be anything wonderful, but in mass they are most effective, and are best grown in that way. The next plant on my list is one of the commonest in Malaya, *Gomphrena*, " Bachelors buttons," white, purple, and mauve varieties. These last in flower for quite four months or more, and flower as hard as they can go all the time. They grow about 1 foot high and after about six months they get rather straggly and need replacing. If you have some coming on in a nursery bed, they can be easily " supplied " when they show signs of becoming *passe*. (Seedlings are ready for planting out in about a month from seed). Keep the colours separate for the best effects.

Vinca rosea, " Periwinkle," brilliant white, and mauve flowers. One of the commonest flowers in Malaya, often found growing in waste places, flowers month after month until it finally gets too straggly and untidy,

* By " Kinta Weed " in *The Planter*, Vol. XVII, April, 1936.

when it will be found usually that there are a host of seedlings coming up underneath the old plant. When cut back, it often dies off, but the seedlings will soon replace it.

Pentas. Rather a new plant in Malaya, but one of the best border plants we have; common colour is a pale mauve, but there are crimson and white varieties even more attractive. It grows to a height of 2 or 3 feet flowering hard all the time. Before cutting back, when it sometimes dies, take cuttings, which strike easily in boxes of sandy soil, using new wood for the cuttings.

Orthosiphon stamineus " Cats whiskers " as they are sometimes called, a shrubby plant that grows into a nice little bush 2 or 3 feet high, throwing up masses of pale lavender flowers on long, flower spikes, the feature of which is the long stamens (not unlike Cleome). It needs cutting back once in every four or five months after which it soon throws out new stems, and is soon covered with flowers again.

These are the six plants I take as the " basis," as it were, of my border but there are others equally as good, though possibly not quite so easily procured. The following are a few. *Barleria,* white and mauve flowers, a very good shrubby plant and quite common. *Crossandra,* or " Japanese Geranium," more often seen in pots, but grows far finer in the border. *Plumbago,* pale blue and varieties, excellent for a shady part of the border. *Mirabilis Jalapa,* " Marvel of Peru " or " four-o'clock," purple, yellow, and white varieties, a very good border-plant, sometimes a little untidy, often found wild on road-sides.

At intervals, shrubs should be planted such as Standard Hibiscus, and perhaps an Ixora or a standard Bougainvillea, though shrubs all need keeping in their place otherwise they grow too large.

Such a border will go on flowering month after month. About twice a year the Angelonia should be cut back hard, it will soon be up again and flowering better than ever. At such times, the border can be cleaned up, dug over and manured and supplied as necessary from the nursery. Personally I find the two dry seasons the best time for an overhaul; about February and again in August. Don't over-crowd plants; give each plant plenty of room to spread itself. Plant out always in wet or showery weather.

For the last few years, I have entirely gone in for gardening as indicated above. Zinnias, Balsams, Pholox, etc. I think, are better in plots, or in some special part of the garden where they can receive extra attention and ample watering.

One point about the border type of gardening is that it stands up fairly well without watering. Its other virtues are that one is not everlastingly digging up the beds and the garden does not continually look like a wilderness. All the plants mentioned are easily obtainable, and as easily propagated, either by seeds or cuttings. And for colour and mass effect, they cannot be surpassed in Malaya.

Poultry.

THE FOOD REQUIREMENTS OF YOUNG CHICKS*

Introduction.

Profitable poultry farming depends largely on the successful raising of young stock. The economic life of a hen seldom exceeds two years after coming into lay, and may be considerably less, for egg production usually declines by then to a level which is unremunerative unless the eggs are of special value for breeding purposes. The periodical replacement with young pullets of a proportion of laying hens must therefore be accepted as an essential part of sound poultry management; and, whether it is the farmer himself or a specialist who carries out the actual operations of hatching and weaning, poor growth in the early stages will have serious consequences. Not only will pullets in general fail to attain typical breed weight by the time they reach sexual maturity—resulting in small eggs, a more or less rapid decline in the intensity of laying once the first flush is over, and possibly also in heavy mortality through inability to stand up to the physical strain of laying, if the birds arrive at that stage—but surplus cockerels will take longer to reach a marketable weight, and the cost of housing and feeding them for a prolonged period may be prohibitive. The growth rate of young chicks thus provides a subject for careful observation; and, where unsatisfactory progress is recorded, investigations should be undertaken without delay to ascertain and, if possible, remove the limiting factor or factors which are in operation.

One should not necessarily begin, however, by assuming that it is the ration or the system of feeding which is at fault, for a number of factors may adversely influence the digestion and assimilation of food. Weak fertilization, faulty hatching or incubation, internal or external parasites, and particularly chills, resulting from exposure to draughts or damp, are the most likely sources of trouble in this country other than the food supply. The poultry farmer should first satisfy himself that they are not responsible before proceeding to blame the ration.

Local Growth Rate.

The author's interest was first attracted to this subject by the consistently poor growth rate of young chicks at the School of Agriculture, Serdang, where a few small flocks have been maintained for some time, mainly for instructional purposes. Systematic weight records were not kept at the School before February 1935, but groups of chicks had been weighed occasionally to obtain a rough idea of their progress, and even from these records it was obvious that matters were by no means satisfactory. Since

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* By G. E. Mann, Principal, School of Agriculture, Malaya, *Malayan Agricultural Journal*, May, 1936.

then, average weights have been recorded weekly for each group from the date of hatching up to the age of 12 weeks, even where two or more groups of the same age were run together for convenience in management. The majority of birds so handled have been pure-bred Rhode Island Reds, and the figures given in this article consequently refer mainly to this breed. Poor growth, however, has by no means been confined to Rhode Islands, but has been just as evident with Light Sussex and with various cross-bred and half-bred chicks.

It is not possible to lay down absolute standards of weight increase, but some idea of what Rhode Island chicks should weigh at ages up to 12 weeks can be gained from Table I. The figures are based on those given in Card and Henderson's text-book. (1).

TABLE I.

AVERAGE WEIGHTS OF PURE-BRED R.I.R. CHICKS.

Age	Weight	Age	Weight
0 weeks	1.3 ozs.	7 weeks	15.5 ozs.
1 „	1.8 „	8 „	19.7 „
2 „	2.6 „	9 „	25.0 „
3 „	4.0 „	10 „	30.2 „
4 „	5.8 „	11 „	34.0 „
5 „	8.5 „	12 „	36.7 „
6 „	11.8 „		

It will be observed that, according to these figures, Rhode Islands may be expected to reach an average weight of about 2¼ lbs. by the age of 12 weeks, and that the rate of growth, as indicated by weekly increments in weight, gradually increases from birth to a maximum at about the 9th or 10th week and subsequently declines somewhat. One must be careful, however, not to regard these averages as an invariable criterion of good progress. They refer to chicks raised under temperate, not tropical, conditions; little information is available as to the precise methods by which they were obtained, save that they represent observations from several farms over a period of three years and " indicate what may reasonably be expected under favourable conditions of feeding and management." There is no evidence, for example, as to whether the chicks were weighed with a full or an empty crop or whether, and if so to what extent, the young chicks were culled. For the purpose of investigations at the School, the practice has always been to weigh with the crop empty and to carry out no culling during the experimental period beyond what has been inevitable through

malformation at birth or death within the first 12 weeks. Records obtained from a number of chicks shew that the average difference between a full and an empty crop at 12 weeks of age is about 1¼ ozs., or nearly 5 per cent. of the desired body weight; while, with a group of 31 R.I.R. chicks of that age averaging 31.5 ozs. in weight, individual weights ranged from 23.5 to 42 ozs. and—by culling to the extent of 20 per cent. by destroying the six lightest birds—the average weight would automatically have been raised to 35 ozs. Evidence is also forthcoming that, with certain animals at least, a strain that has been raised of European parents in the tropics is usually somewhat lighter than its temperature relations. It is therefore not unreasonable to assert that, so far as actual records are concerned, conditions at the School are not conducive to high figures; and, therefore, while it was hoped in the beginning to obtain weights which would at least equal those cited by Card and Henderson, it was felt that an average of not less than 32 ozs. at 12 weeks of age should be regarded as satisfactory.

Throughout the twelve months covered by these investigations, chicks have been hatched and reared both by the natural method and by a Hearson's incubator (50 egg size) followed by various types of outdoor brooder. The Rhode Island parent stock, which was imported from England as young birds in December 1933, has remained in reasonably good condition ever since, but the first generation offspring compares unfavourably in body weight and egg size, presumably as a result of failing to make satisfactory progress as chicks. No serious fault has been found with the management of hatching and weaning operations. With the exception of a few casualties, which may be regarded as more or less inevitable with young birds, the chicks have appeared to be reasonably healthy, both appetite and activity being good, and the records of chicks raised under broody hens have shewn no consistent differences from those raised artificially.

To begin with, a number of autopsies were conducted on 7-day-old chicks. These shewed that the yolk was completely absorbed by that time—in other words, that digestion was functioning normally immediately before and after birth. Enquiries at a number of sources throughout the country then elicited the information that poor growth rate was the rule rather than the exception, at any rate where chicks were raised intensively or semi-intensively; and that, wherever efforts were being made to feed scientifically balanced rations, the ingredients were more or less the same as those then in use at the School, but with small differences here and there in the proportions of the mixture. Again, when judging locally-bred fowls at the Malayan Exhibition in August, 1935, the author was impressed by the lack of weight in many of the exhibits, particularly the pullets. Few satisfactory claims have been received, in fact, and these have seldom been supported by actual figures. Two reports, however, are worthy of note in this place: one, that chicks hatched from eggs supplied by the School and fed on an imported chick meal supplemented by finely chopped boiled eggs reached an average

weight of 8 ozs. at 4 weeks and 19 ozs. at 8 weeks—the other, that chicks raised on Ration B (vide infra) but allowed free range almost from birth weighed nearly 6 ozs. at 3 weeks and 10 ozs. at 5 weeks of age.

Nutritional Value of Rations.

From the above considerations, it was concluded that the problem was essentially one of nutrition. Chicks at the School, and frequently elsewhere, can be allowed only limited range; and, even when free range is available, its value as providing access to a natural source of food such as seeds and insects probably varies between wide limits depending on soil texture and nature of cultivation. There is consequently a risk, even with free range, that chicks may pick up little in the way of " free " food and thus be largely dependent on artificial supplies.

Bearing in mind not only the above but also the fact that cereals and their by-products usually constitute from 50 to 75 per cent. of typical chick rations, the objective at the School has always been to devise a balanced ration suitable either for intensive or semi-intensive systems of management or as a supplementary ration where the extensive system is adopted, and composed as far as possible of locally grown or locally manufactured ingredients. Thus, the only cereals employed are padi and maize; but, in the absence of locally prepared white fish meal of first class quality, these cereals have had to be supplemented by imported animal proteins and, in the earlier experiments, by imported minerals as well.

Prior to February 1935, the food supply consisted of Ration A (*vide infra*), (2), together with succulent greenstuff such as fresh lettuce and *kangkong* leaves and fresh cows' milk which was first skimmed and diluted with an equal volume of water and then fed in the drinking vessels. The mash was soon changed to that of Ration B for reasons which have been indicated elsewhere (3), the main object being to secure a balance between proteins and carbohydrates more in accordance with standards advocated by Halnan (4) and other authorities; but the feeding of good greenstuff and liquid milk was continued.

The composition of Rations A and B is shewn in Table II, while Table III gives the corresponding average weights of chicks up to 12 weeks of age, by which time the young birds have been completely weaned from chick to " growers " rations. This weaning process at the School follows that which is commonly practised in England and other temperate countries, young birds receiving chick rations alone for the first 8 weeks of life, after which the change to the growers ration is effected gradually by feeding 3 parts of chick to 1 part of growers mash during the 9th week, equal parts of each during the 10th week, 1 part of chick to 3 parts of growers mash during the 11th week, and subsequently growers rations only until the pullets are approaching sexual maturity, when layers rations are introduced gradually in the same way. The same growers mash was employed throughout these investigations; and, although it may be capable of improvement, indications

We understand that the information regarding diameter is not now correct, owing to measurements collected since the article was written.

——————— (Editor).

None of our trees approach the dimensions of the " big trees " of North America, nor do they equal the largest trees of the Australian region. They do, however, approach fairly closely the dimensions of the largest trees found in other parts of the eastern tropics.

The tallest tree thus far recorded from the Peninsula was a Tualang (*Koompassia excelsa* Taub.), which was 265 feet in height. The tree was measured by B. F. H. Barnard, Deputy Conservator of Forests, with the aid of a hypsometer. Tualang often reaches large size and certain individuals of this species, in Sarawak, have been recorded as reaching a height of 275 feet.

The next tallest tree which has been recorded is a Kapur (*Dryobalanops aromatica* Gaertn. f.), whose height was 220 feet. Jelutong (*Dyera* spp.) sometimes reaches a height of 200 feet, and there are, perhaps, a few other kinds of trees which occasionally reach that height, although definite records are lacking.

The measurement of the thickness of a tree is made at breast height (4½ feet above the ground), except when there are buttresses, when it is made above these. Diameter is usually measured with the aid of callipers, except in the case of very large trees, when the girth is taken with a tape. The largest tree recorded in the Peninsula is a Chengal (*Balanocarpus Heimii* King) in the Parit Forest Reserve, Kinta District, Perak. This tree was 40 feet 5 inches in girth (151 inches in diameter and was estimated to be 125 feet to the first branch.

THE SINGAPORE GARDENING SOCIETY

At a meeting held on June 4th, called by circular to persons thought to be interested, and by notices in the Press, it was decided to form a Singapore Gardening Society, and a provisional committee was appointed to draw up rules and make other necessary recommendations. At a second meeting, held on June 22nd, the proposed rules of the Society were considered and approved with certain amendments, and it was decided provisionally to hold meetings of the Society on the second Monday in each month. Officers of the Society were elected as follows:—

President	—	Mr. R. E. Holttum.
Vice Presidents	—	Mrs. O. R. S. Bateman. Ven. Graham White.
Honorary Secretary	—	Mr. J. C. Nauen.
Honorary Treasurer	—	Mr. G. Martin.
Committee	—	Mrs. L. W. Geddes. Mrs. C. G. Mawson. Mrs. C. R. Stuart. Mr. Ching Kee Sun.

Up to June 22nd, fifty persons had become members of the Society.

HORTICULTURE IN SIAM

We have been asked to give publicity to the following notification:

The Horticultural Society of Siam will be pleased to receive from firms and institutions dealing in plants, seeds, gardening accessories, books on gardening, botany, etc., all available catalogues, pamphlets, samples, etc., either gratis or in exchange.

Any firm seeking business in Siam in these lines may be assured of this Society's free services, and co-operation in the judicious distribution of their advertising matter and samples.

For further particulars, please apply to:—

The Secretary, C. Narangajavana,
Rosa House, 2419, Tun-nguan-sui Lane,
Suriwongse Road,
Bangkok, Siam.

at present are that it fulfils requirements reasonably well. Results obtained with the various chick rations which have been tested might have been discontinued at the end of the 8th week, but it was considered preferable to continue them up to the 12th week, by which time the use of chick mash had entirely ceased.

TABLE II.

COMPOSITION OF DRY-MASH. RATIONS A AND B.

(Parts by Weight).

Ingredients.	Ration A	Ration B
Padi, ground, husk discarded ..	11	40
Maize, yellow, ground ..	—	12
Bran, white cargo ..	—	20
Groundnut cake ..	4	11
Whale meat meal ..	4	12
Steamed bone flour ..	0.36	2½
Powdered limestone ..	0.12	1¾
Salt ..	0.12	¾
Ferric oxide	—	¼
Red palm oil ..	0.4	—
Supplying approximately ...	21.5 per cent.* D.P. and 78.0 per cent. S.E.	14.3 per cent. D.P. and 65 per cent. S.E.

* D.P. = Digestible Protein. S.E. = Starch Equivalent. (3)

The figures given in Table III are in each case the average weights of three groups, comprising a total of 14 chicks receiving Ration A and 22 chicks receiving Ration B. They indicate that the revised ration failed to effect any improvement in growth during the first 8 weeks of life, but that somewhat better progress was subsequently recorded by chicks raised on Ration B. Thus, at 12 weeks of age, this ration gave an average of 20.7 ozs. with Rhode Islands as against only 14.1 ozs. with Ration A.

If a typical Rhode Island chicken should weigh 2 to 2¼ lbs. at 12 weeks of age, 14 ozs. and 20 ozs. must be regarded as almost equally unsatisfactory. Opportunity was therefore taken of discussing the problem with Professor J. L. Rosedale of the College of Medicine, Singapore, and of surveying some of the available literature on the subject (5) to (10),

TABLE III.

AVERAGE WEIGHT OF R.I.R. CHICKS FED ON RATIONS A AND B.

Age	Normal Averages	Actual Averages at Serdang	
		Ration A	Ration B
0 weeks	1.3 ozs.	—	1.3 ozs.
1 „	1.8 „	—	1.6 „
2 „	2.6 „	2.6 ozs. *	2.2 „
3 „	4.0 „	—	2.7 „
4 „	5.8 „	—	3.1 „
5 „	8.5 „	—	4.3 „
6 „	11.8 „	5.5 ozs. *	5.5 „
7 „	15.5 „	6.8 „ *	7.0 „
8 „	19.7 „	—	9.3 „
9 „	25.0 „	9.3 „	11.5 „
10 „	30.2 „	10.5 „	15.0 „
11 „	34.0 „	11.9 „	18.0 „
12 „	36.7 „	14.1 „	20.7 „

* = records prior to February, 1935.

in the light of which both rations were re-examined in detail under three main headings—proteins, minerals and vitamins.

In relation to the first of these, the main questions which arose were (i) the biological value of the proteins of these rations, (ii) the optimum proportion of good protein in a chick mash. Cereal proteins, especially those of rice, are poor both in quantity and quality, while those of animal and vegetable concentrates vary considerably. A mixture of concentrates should always be employed; but, whereas whale meat meal in combination with groundnut cake is satisfactory for laying hens, a wider variety is possibly needed for young chicks where growth is the primary objective. Analyses of whale meat meal and groundnut cake indicate that they are not deficient in the important amino-acids lysine and tryptophane, but other factors are almost certainly involved, the precise nature of which is not yet fully

understood. One fact, however, is certain—that milk, and particularly dried skim milk, is one of if not the most efficient source of protein for young animals in general. Reliable chick mashes in the British Isles usually contain up to 10 per cent. of dried milk unless the chicks can be given separated milk *ad lib.*

It was found at the School that chicks consumed very little liquid milk, either in the fresh condition or when artificially soured by the addition of rennet. Moreover, the labour required for cleaning drinking vessels used for milk presented difficulties. It was therefore decided to substitute dried skim milk for at least part of the existing protein-rich ingredients and to discontinue the feeding of liquid milk. By using a modest proportion of skim milk in the first place, it was anticipated that any serious deficiencies in the biological value of whale meat and groundnut cake proteins would be exposed.

Opinion seems to be divided as to the optimum proportion of good protein in a chick mash, some authorities recommending about 14 per cent. while others recommend as much as 18 per cent. It was therefore considered advisable not only to introduce skim milk but also to test the effect of increasing the protein content of the ration.

In relation to minerals, no deficiency was apparent in chicks raised on Rations A and B, where the size and shape of frame—as distinct from its weight—and the strength of the bones was satisfactory. Some variation must be expected even with good rations, and undersized birds are usually rigorously culled in commercial practice as soon as they are detected. Moreover, as dried skim milk is comparatively rich in calcium, there appeared to be little if any risk in substituting this for part of the whale meat meal.

The vitamin aspect of the problem was made clearer by reference to the work of Plimmer and his associates, as set forth in *The Biochemical Journal*, and that of Rosedale in this country. Thus, while 0.5 per cent. cod liver oil (or its equivalent) may be accepted as the minimum requirement of fowls for vitamin A, 2 per cent. appears to be the optimum proportion. Reference to Rosedale's figures (11) shews that 1 gram of yellow maize supplies only 6 vitamin A units as against 1,300 units per gram for cod liver oil and 1,200 for unbleached palm oil. In other words, a ration composed entirely of maize would just supply the minimal quantity of vitamin A; but such a diet would, of course, be completely unbalanced in every other respect. To make certain that the requirements for vitamin A are fully satisfied, it is therefore considered desirable that 2 to 3 per cent. red palm oil should be included in all balanced poultry rations in this country, at any rate where free range is not available. No evidence of vitamin A deficiency has actually been observed in young chicks raised exclusively at the School, even on Ration B; but it must be admitted that deficiency diseases may not manifest themselves for some considerable time and may even pass unnoticed when such matters as size of egg, fertility and hatchability are at stake.

Vitamin B_1 was supplied in both Rations A and B by the ground padi and also, in the latter case only, by the white cargo bran (*not* parboiled bran which, owing to its method of manufacture, has lost most of its water-soluble vitamins). Uncertainty was, however, felt in relation to the vitamin B_2 complex, which plays an important part in growth. The main source of this had been " good " greenstuff; but the vitamin B_2 content of greenstuff is extremely variable, and even *kangkong* and lettuce alone might fail to supply enough for a rapidly growing chick. Rosedale's figures (11) now enable one to check the vitamin B content of a ration with fair accuracy so far as those ingredients are concerned which are employed in the diet of human beings. Thus, if yeast is regarded as having a vitamin B value of 100, the requirements of adult chickens are estimated to have a value of 6, while those of young chicks require somewhat more (8 to 10) to balance the increased proportion of proteins. On this basis, Rations A and B appear to have a value of about 5 and 9 respectively. It was anticipated that dried skim milk would help to remedy any deficiency that may have existed, but that recourse to further supplies might prove to be advisable in the form of unextracted dried yeast (*not* extracted yeast, which has yielded up most of its vitamin B in the manufacture of preparations such as Marmite)

The conclusions drawn were thus that both Rations A and B were lacking in biologically good proteins, that Ration A was also deficient in vitamin B, and that Ration B was deficient in vitamin A. A series of feeding trials was therefore drawn up in which these factors could be examined first singly and then in combination. For the first of these trials, Ration C was devised. This was similar to Ration B but included 8 per cent. dried skim milk at the expense of bran, whale meat meal and groundnut cake which were reduced to 15, 10 and 10 per cent. respectively. This mash, with a slightly higher proportion of protein than that of Ration B, was fed *ad lib.* together with the usual allowance of good greenstuff but without liquid milk. The results obtained from three groups of chicks are recorded in Table IV, normal averages being repeated for comparison. The figures are interesting as they appear to demonstrate two facts:—

(*a*) the incorporation of only 8 per cent. dried skim milk in the ration, with a slight reduction in the whale meal and groundnut cake and the exclusion of liquid milk, effected no improvement in growth rate during the first 6 or 7 weeks;

(*b*) chicks fed on this mash then shewed a sudden and conspicuous improvement, so that—although subsequent progress did not altogether come up to expectations—they definitely weighed more than chicks raised on Rations A or B.

On examining the subsequent history of those chickens which had received Rations A and B, indications were observed that there was frequently, but not invariably, a pronounced increase in weight at one stage or another.

TABLE IV.

AVERAGE WEIGHTS OF CHICKS FED ON RATION C.

Age	Normal Averages	Actual Averages at Serdang		
		Lt Sussex x R.I R. (12 chicks)	R.I.R. (5 chicks)	R I R x Native (8 chicks)
0 weeks	1.3 ozs.	1.3 ozs.	1.4 ozs.	1.1 ozs.
1 „	1.8 „	1.6 „	1.6 „	1.2 „
2 „	2.6 „	2.1 „	2.1 „	1.6 „
3 „	4.0 „	3.1 „	2.9 „	2.6 „
4 „	5.8 „	3.7 „	3.9 „	3.1 „
5 „	8.5 „	4.7 „	5.5 „	4.0 „
6 „	11.8 „	5.9 „	7.6 „	5.5 „
7 „	15.5 „	8.8 „	10.5 „	10.0 „
8 „	19.7 „	11.8 „	12.7 „	11.0 „
9 „	25.0 „	14.7 „	16.7 „	13.0 „
10 „	30.2 „	17.8 „	18.3 „	16.0 „
11 „	34.0 „	20.2 „	22.3 „	22.0 „
12 „	36.7 „	23.0 „	26.6 „	25.0 „

With Ration A, this jump took place—when it did occur—during the fifth month, while with Ration B it tended to occur somewhat earlier. Ration C produced an appreciable jump in three successive tests at a much earlier age, about the seventh week. It is interesting to note that a similar jump was experienced in the original records of Plimmer and Rosedale (5), and it is probably a by no means unusual occurrence in young animals generally, although the precise reasons for it are not clear. So far as chickens are concerned, however, it is desirable that—if such jumps must occur—they should do so as early as possible, particularly where table birds are concerned —but that they should not be too pronounced as they might encourage the development of leg weakness if bone formation failed to make equal progress.

The fact remains that the inclusion in the mash of only 8 per cent. dried skim milk had effected no material improvement during the first 6 weeks and had subsequently not led to the attainment of normal weights, although some advance had been made in this direction as is seen by comparing weights at 12 weeks of age. The next step in the investigation appeared to lie in increasing the proportion of dried skim milk.

Experimental Rations.

By this time, however, the problem assumed a much greater degree

of local importance. Reports of poor growth were constantly being received, while the demand for good stock and for reliable advice on feeding had expanded considerably. It would have been preferable to have been able to continue the original policy of examining the effect of each factor separately before testing them in combination; but, with the limited facilities for such work which are at present available at the School, a considerable time would have elapsed before final conclusions could be drawn. It therefore seemed advisable to change the earlier procedure and, in the light of experience, to aim at devising a mash which would satisfy all the known or anticipated requirements. Provided that such a mash gave satisfactory results, further experiments might subsequently be undertaken with a view to eliminating any superfluous ingredient. Ration D, containing not only a high proportion of dried skim milk but also dried yeast and palm oil, was therefore introduced about the end of September 1935. A proportion of whale meat meal was still retained in the ration in order to maintain a narrow protein ratio; but steamed bone flour, powdered limestone and iron oxide were omitted as the ration was considered to supply sufficient minerals without them.

RATION D.

		parts.
Padi, ground, husk discarded	..	20
Maize, yellow, ground	..	20
Bran, white cargo	..	24
Dried skim milk	..	20
Whale meat meal	..	10
Yeast, dried, unextracted	..	3
Salt	..	1
Red palm oil	..	2
		100

(Supplying approximately 17.5 per cent. D.P. and 64.5 per cent. S.E.).

In addition to its high protein content, Ration D has a vitamin B value of 11 while the vitamin A content is equivalent to over 1.9 per cent. of cod liver oil.

The results obtained with this mash are shewn in Table V.

These records shew that progress was excellent for the first 6 to 7 weeks, but that increments then fell behind those recorded by Card and Henderson and left an average deficit at 12 weeks ranging from 5.7 ozs. (about 15 per cent.) in the case of Rhode Islands to 3.4 ozs. (about 10 per cent.) in the case of the R.I.R × Native cross, where hybrid vigour appears to have played a considerable part. The figures for Light Sussex at 12 weeks of age should not be regarded as significantly better than those of Rhode Islands or cross-breds as only 5 birds were involved. In the case of the

TABLE V.

AVERAGE WEIGHTS OF CHICKS FED ON RATION D.

Age	Normal Average	Actual Averages at Serdang.		
		R. I. R. (53 chicks)	Lt. Sussex (5 chicks)	R.I.R. x Native (37 chicks)
0 weeks	1.3 ozs.	1.4 ozs.	1.3 ozs.	1.2 ozs.
1 „	1.8 „	2.1 „	2.2 „	1.8 „
2 „	2.6 „	3.4 „	3.8 „	3.1 „
3 „	4.0 „	5.1 „	5.8 „	4.5 „
4 „	5.8 „	7.1 „	7.0 „	6.5 „
5 „	8.5 „	9.6 „	11.2 „	9.4 „
6 „	11.8 „	12.3 „	14.4 „	12.5 „
7 „	15.5 „	15.6 „	15.3 „	15.5 „
8 „	19.7 „	17.6 „	18.0 „	18.4 „
9 „	25.0 „	20.9 „	21.6 „	22.2 „
10 „	30.2 „	24.6 „	27.3 „	25.9 „
11 „	34.0 „	27.8 „	31.0 „	29.7 „
12 „	36.7 „	31.0 „	35.6 „	33.3 „

Rhode Islands it may be mentioned that one group of 5 chicks included in these figures, which had been hatched and raised under a broody hen, averaged only 25.3 ozs. at 12 weeks, as against 32.3 ozs., 30.7 ozs. and 31.5 ozs. respectively for the remaining three groups which were hatched and raised artificially.

As stated earlier, it is considered that weights over 32 ozs. at 12 weeks of age should be regarded as reasonably satisfactory. Had the group which averaged 31.5 ozs. at 12 weeks been culled to the extent of 20 per cent. and weighed in the evening when the crop was full, the average would have been 36.7 ozs.—equal to that of Card and Henderson. At the same time, the fact that average weights were perfectly satisfactory up to the sixth or seventh week but than fell off suddenly appears to indicate that another factor may be involved. Two such factors have been suggested—minerals and climate. The first of these was tested by raising a few groups of chicks on a modified Ration D in which 2 per cent. powdered oyster shell was included at the expense of bran. The results obtained with a group of 13 Light Sussex chicks, for example, were 12.3 ozs. at 6 weeks, 15.1 ozs. at 7 weeks, 18.5 ozs. at 8 weeks, and 34.4 ozs. at 12 weeks of

age, shewing the same falling off at about the same age, and from these figures it is concluded that the inclusion of additional calcium had no effect on growth rate. It may, however, be observed that Ration D contains only about 1.5 per cent. of calcium oxide, as against 2.5 per cent. when oyster shell was added, and that the latter figure is more in accordance with Halnan's recommendations. The extra minerals may therefore be advisable, but they cannot be definitely regarded as necessary. The only amendment to Ration D which is at present recommended is to increase the palm oil to 3 per cent., thus making quite certain that vitamin A is fully supplied.

The Climatic Factor.

The possibility of a climatic factor has not yet been fully investigated. It appears possible that in the tropics, where development in certain physical respects is commonly earlier than in the temperate zones, the necessity for a high protein content in the ration does not extend over the whole of the period covered by these investigations, and it may be desirable to wean young chicks from chick mash somewhat earlier than has been the practice at the School. It is therefore proposed to test the effct of starting weaning before the ninth week. The results of these further investigations will be published in due course.

Economics.

In conclusion, a few remarks on certain economic aspects of the subject may not be out of place. Excluding transport charges from local dealers and the cost of labour for grinding and mixing, the cost of Ration D at the School is 5.8 cents per lb., as against 3.6, 3.0 and 4.0 cents for Rations A, B and C respectively and 2.5 cents for growers mash. Provided that the major ingredients are purchased in lots of at least 1 cwt., the all-in cost of Ration D should not exceed 8 cents and growers mash 4 cents a lb., but these figures would be considerably higher if supplies were purchased in small quantities at a time.

It is estimated that a heavy breed chick consumes about 4 lbs. of food during the first 8 weeks of life, 4 lbs. during the next month, and 6 lbs. the following month. Excluding waste, the extent of which cannot be discussed in detail in this place but depends mainly on the type of mash trough and system of feeding employed (wet mash being more economical than dry where sparrows are numerous), it should not cost more than 32 cents to feed a chick up to the eighth week and 23 cents for the next month while changing over to growers mash, so long as chicks are raised on a farm scale. For mere backyard operations, however, these costs would be higher, as explained above. Under existing *kampong* conditions, rations such as these would be uneconomic; but, for chicks which will develop into good laying hens or breeding cockerels, the above estimate cannot be regarded as high in Malaya, where imported rations are even more expensive. For the farm scale production of table birds, breeding costs to 16 weeks of age would be about 80 cents and the birds should then average

about 3 lbs. each. Such fowls might not compete directly with *kampong* table birds in the ordinary local markets, where there are usually ample supplies of table birds scaling 2½ to 3 lbs. live weight and selling at 50 to 60 cents each; but the quality of market fowls at this price leaves much to be desired, particularly in respect of tenderness, succulence and proportion of meat to bone, and it is by no means impossible that table birds raised on a milk-rich diet such as Ration D would soon command a special market of their own, with correspondingly high prices, as in fact already occurs with local capons. Under backyard conditions, a 16 weeks bird would probably cost the owner $1.50 in food, if fed on these rations alone, but this could be considerably reduced by the use of household scraps after the weaning stage.

If large scale poultry farmers existed in this country, they would naturally purchase foodstuffs in bulk, either buying each ingredient separately in the cheapest available market and carrying out grinding and mixing operations with their own labour, or purchasing mixed rations (if available at reasonable prices) in quantities which could be stored for a convenient length of time, which would depend upon the risk of deterioration. Ground cereals rapidly become infested with pests in this country unless they are stored carefully in a dry place. For the purchaser of small quantities of say 7 or 14 lbs. at a time, it should be possible to market a mash in sealed air-tight tins thereby avoiding not only damp but the possibility of adulteration. In this form, a 7 lb. tin of Ration D could probably be retailed at about $1.00. A useful alternative for both small and bulk supplies would lie in marketing the mash without its cereals and bran in the form of a "concentrate" to which the poultry keeper would add ground padi and bran, with or without maize, in accordance with instructions supplied with the container. Marketed in either of these forms, Ration D should overcome the legal difficulties which at present restrict the sale of dried skim milk in this country, and should go far towards solving what is at present a serious problem in the improvement of the existing standard of poultry husbandry.

Summary.

Attention is drawn to the unsatisfactory growth of young chicks which is commonly experienced in Malaya.

The average weights of young chicks from birth to 12 weeks of age, fed on four different rations, are recorded and compared. They indicate that a comparatively high proportion of milk in the ration is desirable if satisfactory growth is to be secured. Thus, a ration containing 20 per cent. dried skim milk gave average weights with Rhode Island Reds of 31.0 ozs. at 12 weeks, as compared with 14.1, 20.7 and 26.6 ozs. for other rations and an expectation of 36.7 ozs. in a temperate climate.

Average weights at the School could be raised to normal if chicks were culled more rigorously and if they were weighed with a full crop. There

is, however, evidence that some other factor, so far undetermined but possibly climatic, is involved.

Acknowledgments.

The author wishes to express his indebtedness to Professor Rosedale for his kindly interest and help. He also has to acknowledge the assistance rendered in these investigations by those members of his staff and students who have been responsible for preparing and feeding the rations and for recording the figures on which this article is based.

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Miscellaneous.

GREAT SNAKES

Despite the writings of such authorities as Kim (in the *Statesman*), Mr. Howard (*Forest Pocket Book*), and Colonel Wall, I.M.S. (*The Poisonous Terrestrial Snakes of India*), there are apparently many points about snakes still unknown to science, which will undoubtedly appeal to the scientific readers of the *Indian Forester*. Little did I realise what terrible creatures there were in India, or how precarious human life must be in this land. Recently, however, a little book (" The Friend in Pocket," by R. S. Dutt Bharaddwaj) fell into my hands dealing fully and faithfully with snakes, scorpions, bites of " mad dogs and rabbits," and such like fearsome fowl, which has opened my eyes and made me despair of ever drawing my pension.

Let us start first with the snakes, of which there are ten deadly varieties. The most deadly is called " Kul Nashak," because " if it bites a twig, not only will the twig burn to ashes, but also the bush or tree from which it came. Similarly if it bites a man he will die and his relatives will meet the same fate." What a cheerful prospect ! There are evident advantages in being a kinless loon.

Another snake—the " Agan Jhar "—is so full of venom that " the grass through which it passes burns." A jolly little pet in a fire-protected forest, but what a godsend to the harassed Range Officer when recording that troublesome entry in every fire report—the origin of the fire. To be bitten by this snake is evidently an unpleasant rather than deadly experience, as " the colour of the body of the person whom it bites becomes bluish, his hairs fall and teeth begin to shake." Whether he remains a blue bald body with shaky teeth for the rest of his life or reverts to normal is not stated.

Of the ordinary cobra—" Kala Nag "—we read:—" Dimensions, Nothing fixed. Length varies from 9 feet to 4 yards or even more. Light of lamp becomes dim in its presence on account of poisonous effects on the air about the lamp." Doubtless this explains the rapid increase of hydro-electric schemes in India.

The " *Nag Sankh Raikh* " is a deadly variety. " Within 10 minutes the person bitten by this snake gets into toxicity and dies after snuffing. If there is any extraordinary heat in the brain on account of his being a celibate or a youth, his brain would become punctured, and the case would go out of control and the patient become incurable." I am glad I'm neither a celibate nor a youth anyway. But the most difficult of all to avoid—and therefore perhaps the most to be feared, is the " Nag Tarakana," which, by holding its tail in its mouth " can jump up two to three yards and then

bites a man as far as possible above his belly, and after biting, it runs off very quickly "—the cowardly brute !

But enough of these horrors. Let us pass on to the correct diagnosis of snake bites. " Ordinarily the following symptoms are found in a patient bitten by a poisonous snake:—

Acidity of teeth.

Lividity of teeth.

The patient cannot chew barly corn (No wonder, with such teeth !)

The Sun and Moon will not be visible in their real forms."

There are other symptoms also, but these will perhaps suffice.

Why snake bites should be so deadly or unpleasant is made clear from the following:—" As soon as the venom of a snake enters the skin, it becomes four times, and when it comes in contact with blood it grows eight times of the original quantity, and in flesh and bones it increases to 16 and 32 times respectively of the original one. As soon as the breathing is affected, it becomes there 64 times and consequently the person suffers from nasal intoxation and dies."

Now let us move on to treatment. Fortunately there are many cures for snake bite, too many to detail here, but one or two, which are possibly new to my readers, may be mentioned. " Recipe No. 1.—Dry a frog and make a fine powder thereof by passing the same through a fine cloth. Apply to the bitten part." (And if you are not pretty nippy in getting the frog through the fine cloth, the patient may be dead).

" Recipe No. 4.—Peppers washed till their skin is off and their colour becomes white should be dried in the shade. They should then be put in the fresh egg of a pea-hen. The mouth of the egg should then be closed with wax and the egg buried in a granary of rice. When dried it should be taken out of the granary and the contents thereof made into a fine powder and used as snuff." What happens if the pea-hen is dilatory over laying the fresh egg is not stated. What a subject for a Heath Robinson picture !

I think we must award the prize for the best cure to the following:—" Recipe No. 7.—The part bitten by the the snake should be excised, and the anus of a hen, after removing hairs therefrom, should be attached to the wound. After ten minutes the hen will be restless; she should not be removed till she is dead. It will cure the patient. This may be repeated if found necessary." One might suppose that the process of removing hairs from the specified part would make most hens distinctly restless in well under ten minutes, but perhaps the hardy Indian hen likes the gentle tickle. Distinctly a line of research for the Forest Entomologist to follow up.

If, despite all these and many other useful recipes, the poor patient dies, the author of the book gives some sage and emphatic advice regarding the disposal of the body—" I do not hesitate in insisting upon the principle of throwing the dead body in some river, so that there may not be the least possibility of burning or burying a person alive."

For which relief, much thanks !

Passing over scorpions, lizards and wasps, we come to " Remedies against the bites of mad dogs and rabbits," which calls up a vision of an elderly and portly D.F.O., or Conservator fleeing before the gnashing jaws of an infuriated bunny. But happy thought—perhaps the *t* should be an *e* ?

Finally this excellent little book (price 12 annas, and can be had from " all booksellers of your town,") has an invaluable chapter for all forest officers, giving medicines to overcome the effects of excessive alcohol. Is there a forest officer who will not endorse—" Recipe No. 7.—Vomiting will also lessen the effects of the intoxication."

Let us conclude this brief review with a word of thanks and appreciation to the author who, as he has explained in the preface, " in commemoration of Silver Jubilee, begs to offer a present to his motherland, India, in the form of this treatise." When its heartlifting merits are fully known it should indeed prove a best-seller.

" S."

WHAT ARE THE LARGEST TREES IN THE WORLD?

Records have always had an irresistible attention for the human mind. There are few people, for instance, who are unable to tell you the height of the highest mountain or where the deepest part of the ocean is. Until fairly recently however there was considerable doubt regarding what kinds of trees were the tallest in the world and where they grew, the rival claimants for this honour being the Californian redwoods (*Sequoia sempervirens*) and the Australian Eucalyptus (*E. regnans*). These doubts were set at rest by the investigations of Mr. Lane Poole of Australia, and the figures given in the article under review confirm his conclusions. Incidentally the writer of this article brings out how very unreliable most of the reports of the heights of these forest giants are and what care is necessary in verifying reports and in checking measurements. A number of trees have been reported " on reliable authority " to be over 400 feet high and one even of 480 feet has been mentioned but no authenticated measurements have ever been made of a tree larger than 364 feet, which is at present the world's tallest tree as far as is known. It is, indeed, surprising that the measurements of the world's tallest trees are so unreliable. Though there are certain difficulties in the way of accurate measurement such as difficulty in seeing the top and the bottom at the same time or of allowing for the slope of the ground or the leaning of the tree, yet they are not half as great as the difficulties a surveyor encounters when he is, for instance, measuring the height of an inaccessible mountain.

The tallest tree in the world at the present time is a redwood tree standing on N. Dyerville Flat, in the Humboldt State, Redwood Park, California, and is 364 feet high. It was measured with a transit by Enoch P. French, Superintendent of the Park. (Mr. Lane Poole's mention of a tree in this locality as 346 feet high in this report on the Tallest Tree in the *Australian Forestry Journal* of the 15th January, 1927, and copied in the *Indian Forester* for September of that year, appears to be a printer's error, since another tree of larger size is mentioned as an " also-ran.") Another redwood tree located on Bull Creek Flat, at the junction of Bull Creek with the South Fork of Eel River, was measured by the same party in 1930 as 361 feet high. This is presumably the same tree as that mentioned by Lane Poole as having been measured by a party under Mr. David T. Mason on 28th March, 1926, as being 359 feet high when measured from one direction and 368 feet high when measured from another direction, using a transit in each case. Much difficulty was experienced in measuring this particular tree because the top could only be seeen from a position rather close to the base. There are a number of other living redwood trees over 330 feet high which have been measured.

By H. D. Tiemann, *Journal of Forestry*, Vol. XXXIII, No. 11, and reviewed in *The Indian Forester*, March, 1936, by M. V. Laurie.

A Douglas fir tree which grew in Seymour Valley at Vancouver, B.C., and was felled in 1895 is reported to have been 417 feet high with a clear bole of 300 feet to the first branch. The report is well substantiated from a number of sources but has been much questioned. If true, however, it establishes the Douglas fir in former times as one of the largest trees in the world.

There are several reports of trees of *Eucalyptus regnans* (Mountain Ash) in Australia that are supposed to have grown over 400 feet in height, but none of these have been authenticated. One tree called " The Baron " was alleged to be 464 feet high, and a photograph of it was exhibited at the Melbourne Exposition in 1888, but subsequent measurement by a government surveyor showed it to be only 219¾ feet high ! This shows how far such " reports from a reliable authority " can be trusted. The tallest properly authenticated measurement is of a " mountain ash " tree at Colac 347 feet high, and there is a very plausible report of another tree two miles from Thorpsdale in Gippsland which was said to have been measured as 370 feet when standing and verified as 375 feet when felled after allowing for the stump. Unfortunately this is a report from memory and cannot be fully substantiated. All these trees, however, are now no longer living and it is doubtful whether there are any Eucalyptus trees over 300 feet high alive to-day. The Californian redwoods, therefore, are the tallest living trees by some 50 feet or more.

It is of some interest to compare India's largest trees with these giants. India has never figured with reference to trees of outstanding dimensions and many of the trees mentioned below, most of which are conifers from the Himalayans, have been felled or disappeared since they were measured:—

Cedrus deodara	..	240 feet high—Sutlej Valley
		240 feet high—Kulu Dungri Temple Grove
Picea morinda	..	215 feet high—Jaunsar (Mundali)
Abies pindrow	..	206 feet high—Jaunsar (Mundali)
Abies pindrow	..	202 feet high—Jaunsar (Mundali)
Tectona grandis	..	192 feet high—S. Malabar
Pinus longifolia	..	180 feet high—Tons Valley, Chakrata Division
Pinus excelsa	..	165 feet high—Kashmir
Shorea robusta	..	161 feet high—Bengal

The tallest known Indian trees thus fall short of the world's record by over 120 feet.

Diameters or girths, though more accessible for direct measurement, are difficult to compare accurately on account of variations in the height of measurement and irregularities due to basal swelling, buttresses and so forth, not to mention trees that fork so low down as to be doubtfully compounded of two or more trees that have fused together. A chestnut tree (*Castanea sativa*) at the foot of Mount Etna holds the world's girth of 190 feet (measured in 1780) and 204 feet (measured in 1836). It is still living, but has broken into three separate fire-scarred but vigorous pieces.

The redwoods though tallest have by no means the largest girths.

Two *Sequoia gigantea* standing in the Sequoia National Park called General Sherman and General Grant have mean diameters of 24 feet each at a height of ten feet from the ground. These appear to be the largest living trees of their kind though there are reports of larger ones that have since disappeared; thus Mr. Tiemann mentions a tree in the Calaveras grove felled in 1853 with a diameter inside the bark at six feet from the ground of 25 feet. (The bark was 15—18 inches thick). Forty-nine people danced on the stump. The passing of such a magnificent tree should have been an occasion for mourning rather than jubilation.

The greatest authenticated record girth of *Eucalyptus regnans* in Australia is the tree called " King Edward VII " near Marysville, Victoria. It was 25½ feet in diameter, 10 feet from the ground, and was alive in 1918, but is now dead.

A Kauri tree (*Agathis australis*) of 24 feet in diameter is mentioned, which is phenomenal since there is no root swelling and Kauri has a form factor of approximately 1.00 ! It had a clear bole of 80 feet. Another of 22 feet diameter and 100 feet clear bole is also mentioned.

There are a number of other species with greater girths than those recorded above, but they usually have short branched or bloated trunks (*e.g.*, *baobab* and *banyan*), and are consequently less impressive.

For sheer volume of bole the Kauri tree " Kairau " of 22 feet diameter mentioned above, containing 31,416 cubic feet inside the bark below the first branch, and the redwoods (one is mentioned of containing 361,366 board feet or 30,114 cubic feet of timber), hold the record.

Ages have been reported up to 6,000 years, but it is doubtful whether anything over 3,500 to 4,000 years can be substantiated.

As regards Indian trees, again the largest girths are very considerably smaller than the world records. The reports of exceptionally big girths are comparatively few, the largest at present known being as follows:—

Cedrus deodara	..	31 feet 6 inches at 6 feet—Bashahr, Punjab
Abies pindrow	..	21 feet—Kashmir
Teak	..	26 feet 7 inches—Pahok, Burma
Shorea robusta	..	25 feet 8 inches—Ramnagar, U.P .

It is quite probable, however, that larger trees may exist which have not been reported.

Readers will probably be interested to learn how the trees of Malaya compare in height with those in other parts of the world, and the following extract is accordingly appended. It is taken from an article " The Size of Trees in the Malay Peninsula," by F. W. Foxworthy, published in the *Journal of the Malayan Branch of the Royal Asiatic Society*, Vol. IV, Part III, December, 1936.

Reviews.

An Outline of Malayan Agriculture.

Compiled by D. H. Grist, Department of Agriculture, S.S. & F.M.S., 1936, Price $3.

This comprehensive work replaces the earlier Handbooks of Malayan Agriculture, and is a thoroughly up-to-date review of the subject. It has been compiled by Mr. D. H. Grist, Agricultural Economist, with the collaboration of other officers of the Department of Agriculture, and also of other Government officers, notably in the case of the chapter on land tenure.

The book consists of 359 pages of text, with full appendices and index, and contains 86 excellent illustrations, mostly reproduced from photographs. There are also two maps, one geological and the other general, both printed in colours and folded in at the end of the book. The text is divided into six parts, entitled Agricultural Conditions, Agricultural Practice, Major Crops, Secondary Crops, Minor Crops and Stock. The first part gives an interesting historical survey of the development of Malayan Agriculture, a chapter on land tenure which is "the first complete presentation of the subject as applying to the whole of Malaya," and chapters on agricultural policy, co-operation and the organisation of agricultural services. The chapters on agricultural practice give general accounts of local methods of cultivation, the nature of local soils and their necessary treatment to ensure conservation and fertility, with references to recent experimental work on manures.

The chapters on the various crops are in all cases very full summaries, concluding with references to recent publications from which more detailed information can be obtained. These references are mostly to papers published in the *Malayan Agricultural Journal* and are an impressive record of the variety and thoroughness of the experiments on tropical crops which have been carried out by the Department of Agriculture in recent years. To take a random sample of treatment, the chapter on coffee may be selected. The sub-headings are: History, Area, Varieties, Production, Cultivation, Manuring, Yields, Diseases and Pests, Preparation for market, Costs, Trade and Prices. The final section on Stock includes chapters on cattle, pigs, poultry and fresh-water fish.

There is no aspect of local agriculture which is not mentioned and its existing status summarised. The book is in fact a most admirable production which should find its place on the shelves of all who take an interest in local agriculture or who may require for handy reference a convenient summary of current information on local crops.

R. E. H.

Cultivated Crop Plants of the British Empire and the Anglo-Egyptian Sudan (Tropical and Sub-tropical)

By H. C. Sampson, C.I.E., B.Sc., F.L.S., (Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information: Additional Series, XII). London, H. M. Stationery Office, 1936. Price 6s. 6d.

This book of 250 pages is based on replies received to a questionnaire sent to all tropical and sub-tropical countries in the British Empire; the information so received was compiled and edited by Mr. Sampson at Kew. The proposal for the compilation of the book originated at the Conference of Colonial Directors of Agriculture which was held in London in 1931, the object being to make generally available information regarding the occurrence of the various crop plants in the countries concerned, in order to facilitate their introduction to other parts of the Empire. This object has been very successfully accomplished, and the book will be a most useful record for all tropical and sub-tropical agriculturists who are interested in the possible introduction of new crop plants.

The book is arranged alphabetically according to plant genera, and the species alphabetically in each genus. There is no index to common or local names, but there is a list of well-known botanical names which have been abandoned as incorrect according to the rules of botanical nomenclature. Under each species is the following information:—

1. Its natural geographical range.
2. Its native or local names in various countries.
3. A brief note on its uses.
4. A list of countries in the Empire where it occurs, arranged according to the degree of its importance as a crop; whether an old introduction, successfully established, still under trial, abandoned or failed after trial.

This information will give an enquirer a good idea of the kind of climate in which any given crop will flourish and whether it is likely to be useful in his own country. It will also indicate to him the most convenient place to which to apply for seeds or other planting material if he wishes to make a trial introduction.

A close examination of the book reveals, as one would expect, a rather unequal interpretation of the term "Crop plants." It is evident that the persons who answered some of the questionnaires included plants which others would have excluded as unimportant. Then again, plants which are strictly crop plants in some parts of the world are uncultivated casuals in other parts; they might therefore be omitted from the records from the latter. It is clear that the officer of the Malayan Department of Agriculture who supplied the local information for the list interpreted the term more strictly than the officer in Sarawak. In a compilation of this nature, such

differences are unavoidable, but it seems a pity that the records could not have been made more complete by listing the occurrence of common plants even when they are not truly crop plants; this has in effect been done in some cases but not in others. As an example, we may take the species of Cassia. *C. alata* is a very old introduction to Malaya, and is common everywhere, but the only countries for which it is recorded are Gold Coast and Kenya, where it is being tried for shading plantation crops. *C. fistula* is mentioned as occurring in many other countries, but not in Malaya, though it is common in gardens here. *C. grandis* (from Central America) is also very common in the north of the Peninsula, but is only mentioned from the Solomon Islands, Baroda and the Seychelles. Other species of Cassia might also similarly be mentioned, and a large number of other plants.

The Malayan records of the more strictly crop plants appear to be fairly complete. A surprising omission is *Momordica charantia*, the Bitter Gourd; another is the Guava. *Passiflora edulis*, though now well established at Cameron Highlands, is not mentioned. The Cashew nut is said to be " rare " in the S.S. & F.M.S., but it is common enough on the east coast. The common edible bamboo, which is much cultivated in Singapore, is not mentioned at all; the local cultivation of the Chinese cabbage is also omitted. Malayan records are omitted for practically all the lesser fruits, even the Duku and Langsat; this was presumably done as a matter of policy. In the division of plants introduced but not yet in general cultivation, there is no Malayan reference for many species which have long been in cultivation in the Botanic Gardens, Singapore. It is clear that the Gardens reports were not consulted in compiling the list.

The last 70 pages of the volume are devoted to " Crop Notes." These consist of useful short accounts (usually two or three pages to each) of a limited number of crops. These are mostly staple food crops of indigenous peoples, but rice is not included. . There is much information on the various races of the crops in question and references to literature where further details are available.

The above criticisms are on matters of detail, and merely indicate some of the inevitable minor inequalities which are bound to occur in a first compilation of this kind. It is to be hoped that the book will be revised at a later date, and the collaborators asked to bring their records to a more uniform condition. Meanwhile it is already a very useful work, for which we are grateful to Mr. Sampson and all his collaborators.

R. E. H.

The Malayan Agri-Horticultural Association.

Thirteenth Malayan Exhibition

By the time this issue appears, the Annual Malayan Exhibition will be preparing to open its doors to the general public on the 1st August.

The following is a list of competitive sections with the names and addresses of honorary section secretaries.

Agriculture	—	Mr. R. G. H. Wilshaw,
Oils and Fats	—	Mr. Gunn Lay Teik,
Village Industries	—	Haji Mohamed Eusoff and Inche Hamid Dom,
Art and Photography	—	Mrs. R. Macgregor and Mrs. R. A. Barbour,
Horticulture	—	Mr. Chew Sze Foong,
Preserves and Confectionery	—	Mrs. A. E. Llewellyn,
Cats	—	Mr. H. J. C. Kulasingha,
Poultry	—	Mr. L. Fonseca,
Schools	—	The Inspector of Schools, Selangor,
Models Section	—	Mr. W. J. D. Trengove.
Needlecraft and Handwork	—	

Owing to foot and mouth disease having broken out in Kuala Lumpur District, it is regretted that there will be no cattle, pigs and goats sections this year.

The general lay-out is to be somewhat different from last year, as two new permanent buildings will be ready in time for the Exhibition, one for Horticulture and the other probably for Village Industries, Schools, etc. Endeavours are being made to deal with the dust nuisance and a half inch thick plank ceiling has been put in the main building which should reduce the temperature considerably.

An additional attraction this year will be a Models Section, and part of the main building will be transformed into a palm court with a lily pond, fountain, and seating accommodation for visitors. The entrance to the Horticulture Section will be from the palm court.

The catering in the main restaurant will be in the hands of the Hotel Majestic. The Colonial Restaurant will be responsible for catering arrangements for Chinese visitors to the Exhibition. A Mohomedan restaurant will also be provided.

Annual General Meeting

The Annual General Meeting of the Association was held on the 12th May, 1936, at the Association's office, 8, Barrack Road, Kuala Lumpur. Mr. F. W. Douglas, President of the Association, took the Chair.

On the proposal of Mr. F. W. South, seconded by Mr. Pat Zilwa, the Annual Accounts and Report for 1935 were unanimously passed and adopted.

The Chairman expressed the thanks of the Association to Mr. H. L. Barnett for his work in connexion with the Malayan Christmas Hampers, and he also thanked members of the Committee for their assistance during the past year.

Mr. John Hands said that he would like the Association to record the debt it owed to their President, Mr. F. W. Douglas. It was a debt they could never liquidate. He pointed out that the annual Show owed its success to Mr. Douglas, and he would ask that this mark of appreciation be recorded in the minutes of the meeting. Mr. Hands also proposed a vote of appreciation to Dr. Tempany and to the Department of Agriculture.

On the subject of the stadium, the Chairman said that he had received a letter from the Football Association of Selangor giving the assurance that the Stadium would be used more often this year. This he said was very heartening.

Under Rule 11 (3) the Chairman asked if the meeting would be willing to deal with the subscription of Branches and affiliated Societies. The meeting agreed.

On the proposal of Mr. E. W. Cooke, it was decided that Branches should pay $15 per annum (all members would get *The M.A.H.A. Magazine* free). The fee for affiliated Societies was raised from $5 to $10.

Office Bearers.

The following were elected office bearers for the coming year:—

President:— Mr. F. W. Douglas,

Vice Presidents:— The Hon'ble the Adviser on Agriculture, M.S. (Mr. F. W. South), *ex officio.*
The Hon'ble the Raja Muda of Perak,
Mr. John Hands, M.C.H.,
The Hon'ble Mr. Lai Tet Loke, M.F.C.,
The Hon'ble the Raja Uda, M.F.C.,
Tengku Yacob—Kedah,
Tengku Ahmad—Muar,
Tengku Stia—Trengganu,
Dato Perdana Mentri, Kelantan,
Capt. S. H. Whitworth, M.B.C.V.S.

General Committee.

Messrs. L. Y. Swee, S. C. Colomb, G. E. Mann, Che Salleh, E. W. Cooke, Pat Zilwa, M.C.H., T. D. Marsh, R. Macgregor, H. S. Tallalla, R. G. H. Wilshaw, Eu Kee Eng, J. Milsum, V. L. Cachemaille, H. L. Barnett and Chew Sze Foong.

Stadium Committee, Messrs. F. W. Douglas, Pat Zilwa, M.C.H. and H. L. Barnett.

Auditors

Messrs. Walter Grenier & Co. were re-elected auditors for 1936.

REPORT FOR THE YEAR ENDING 31st DECEMBER, 1935.

The following gentlemen served on the General Committee of the Association during the year:—

President:— Mr. F. W. Douglas,

Vice Presidents:— The Hon'ble the Adviser on Agriculture, M.S. (Dr. H. A. Tempany, C.B.E.), *ex officio*,
The Hon'ble The Raja Muda of Perak, M.F.C.,
Mr. John Hands, M.C.H.,
The Hon'ble The Undang of Rembau, M.F.C.,
The Hon'ble Mr. Lai Tet Loke, M.F.C.,
The Hon'ble The Raja Uda, M.F.C.,
Tengku Yacob, Kedah,
Tengku Ahmad, Muar,
Tengku Stia, Trengganu,
Dato Perdana Mentri, Kedah.

General Committee:—Messrs. L. Y. Swee, S. C. Colomb, J. L. Ross, Che Samah, C. Van Dort, E. W. Cooke, F. W. South, B. Bunting, M. Dukes, F. C. Cooke, J. A. Baker, V. H. Brunt, Pat Zilwa, M.C.H., and Capt. Hashim.

Membership.

Membership at the close of 1935 was 671 (Life members 98, Ordinary members 573). Affiliated Societies numbered five.

Finance.

Debentures. $2,000 worth of debentures were redeemed in 1935.

The profit on the Twelfth Malayan Exhibition was $2,272 as compared with $507.73 in 1934.

Twelfth Malayan Exhibition.

The annual Malayan Exhibition was held as usual at Kuala Lumpur on 3rd, 4th and 5th August, 1935 and was opened by His Excellency the High Commissioner.

Attendance was 30,036 as compared with 22,588 in 1934; a full report appeared in *The M.A.H.A. Magazine*, October, 1935.

Stadium.

The Stadium was used throughout the year under review by the F.M.S. Police at a monthly rental.

The ground was also used for certain of the football matches played in the Selangor League Competition and in the Selangor Cup Competition.

The final of the Malaya Cup Competition was played at the Stadium on the 10th August, 1935 when there was a record attendance.

The Selangor Badminton Club continued to use throughout the year the courts in the main building in the Exhibition grounds.

All-Malayan Padi Competition.

This was again held in 1935 and proved an outstanding success. The challenge shield was won by Che Demang Mohamed bin Daud of Malacca.

All-Malayan Rubber Competition.

This was inaugurated for the first time this year and the first prize was won by Haji Mohamed bin Lehar of Rantau. A full report of this appeared in *The M.A.H.A.Magazine*, October, 1935.

District Shows.

In addition to the award of the bronze medals to the local shows held in connection with the All-Malayan Padi Competition, silver and bronze medals, diplomas and certificates were awarded to District Shows held at Teluk Anson, Kuala Trengganu, Kuala Selangor, Bentong, Kuala Langat, Kuang, Sabak Bernam and in Kelantan.

Malayan Christmas Hampers.

The scheme, commenced in 1933, for the despatch to Great Britain of hampers of Malayan produce as Christmas presents was again successfully organised in the year under review. A total of 312 hampers was despatched as compared with 236 in 1934.

Special Coconut Section.

To give effect to certain of the recommendations of the Vegetable Oils Committee, a special Coconut Section was held at the Exhibition and this proved to be a great success. The first prize for small holders' copra was won by Che Awang bin H. Idris of Parit Buntar and for Estates, Bagan Pasir Estate, Bagan Datoh. A full report of this appeared in *The M.A.H.A. Magazine*, October, 1935.

The M.A.H.A. Magazine.

The Association's quarterly journal, which was revived in 1933, was published regularly throughout the year.

Acknowledgement.

This opportunity is taken of expressing keen appreciation of the services rendered in connection with the Exhibition by the large number of voluntary workers, Section Secretaries, Judges, Stewards and helpers; by the Y.W.C.A., the Girls Guides' Association and the Boy Scouts' Association; by District Officers, the Agricultural and Co-operative Societies Departments and the Rubber Research Institute of Malaya; by the F.M.S. Railways, the Electrical and Posts & Telegraphs Departments.

Recognition is also made of the very great help given by the Police Department, both in connection with the Exhibition and the Malaya Cup Final, and of the unstinted support accorded throughout the year by the entire press of Malaya.

By Order of the Committee,
H. G. Birnie,
Secretary.

MALAYAN AGRI-HORTICULTURAL ASSOCIATION.

Balance Sheet as at 31st December, 1935.

LIABILITIES.

DEBENTURES:—			
AUTHORISED.			
15,000 2½% Debentures of $10 each ...		$150,000 00	
ISSUED.			
11,520, 2½% Debentures of $10 each fully paid		115,200 00	
Less 50 Debentures redeemed, December 1934	$ 500.00		
Less 200 Debentures for redemption ...	2,000.00	2,500 00	$112,700 00
FORFEITURE OF DEBENTURE ACCOUNT ...			75 00
LIFE MEMBERSHIP SUBSCRIPTIONS ...			800 00
CREDITORS:—		$	
(i) Debenture Interest for the year ...		2,867 50	
Less Interest paid on debentures redeemed ...		50 00	
		2,817 50	
(ii) Unclaimed Debentures and Interest ...		2,029 79	
(iii) Miscellaneous ...		1,889 32	6,736 61
INCOME AND EXPENDITURE ACCOUNT:—			
Balance brought forward from 1934 ...		3,069 17	
Add Excess of Income over Expenditure for year 1935		319 81	3,388 98

ASSETS.

CASH IN HAND, AT BANKS ON GENERAL ACCOUNT & DEBENTURE Redemption Account			$ 7,179 57
SUNDRY DEBTORS			795 67
MEDALS, as valued at date hereof			143 15
FURNITURE, FITTINGS, ETC., at cost less depreciation previously written off		904 51	
Add additions during year		128 00	
		1,032 51	
Less depreciation for year		182 51	850 00
EXHIBITION GROUNDS, BUILDINGS, ETC., at cost in the case of the Site, and at cost less depreciation for the other assets			
SITE, at cost		28,334 00	
STEEL, BUILDINGS, etc. ...	$31,577.60		
Less depreciation for year ...	789.40	30,788 20	
RADIO BUILDING ...	240.00		
Less depreciation for year ...	40.00	200 00	
OFFICE ...	290.00		
Less depreciation for year ...	290.00		
FENCING	3,250.00		
Less depreciation for year ...	300.00	2,950 00	
LATRINES ...	1,900.00		
Less depreciation for year ...	100.00	1,800 00	
SWITCH ROOM, at cost ...	40 00		
Less depreciation for year	10.00	30 00	64,102 20

We have examined the above Balance Sheet with the Books and Vouchers of the Malayan Agri-Horticultural Association and have received all the information and explanations we have required.

The books in respect of the Debenture Issue have not been submitted to us for audit.

Subject to the above, we are of opinion that the foregoing Balance Sheet is properly drawn up so as to exhibit a true and correct view of the state of the Association's affairs as at 31st December, 1935 according to the best of our information and explanations given to us and as shown by the Books of the Association.

KUALA LUMPUR,

25th April, 1936.

WALTER GRENIER & CO.,

Certified Accountants,

Auditors

STADIUM at cost in the case of Site, and at cost less depreciation for the other assets,			
SITE, at cost ...	...		36,666 00
SEATS ...	7,400.00		
Less depreciation for year ...	740.00		6,660 00
FENCING ...	3,325.00		
Less depreciation for year	300.00		3,025 00
TURNSTILES ...	1,500.00		
Add additions during year ...	358.00		
	1,858.00		
Less depreciation for year ...	90.00		1,768 00
CHANGING ROOM ...	1,800.00		
Less depreciation for year ...	90.00		1,710 00
LATRINES ...	350.00		
Less depreciation for year ...	100.00		250 00
CLOCK ...	...		1 00
COOLIE LINES, at cost ...	...		550 00
			50,630 00
		$ 123,700 59	$ 123,700 59

MALAYAN AGRI-HORTICULTURAL ASSOCIATION

Income and Expenditure Account, 1935 Exhibition.

1934	EXPENDITURE.				
$ 1,391 56	To Train Fares and Freight ...		$ 1,673 60		
2,685 91	„ Temporary Buildings ...		3,309 95		
739 00	„ Salaries ...		784 00		
78 83	„ Labour ...		210 26		
100 00	„ Postages ...		154 72		
604 22	„ Advertising ...		714 16		
512 09	„ Medals ...		527 14		
$ 907 28	„ Prizes ...		1,304 72		
208 06	„ Stationery ...		259 61		
624 04	„ Sanitary Board ...		1,050 12		
3 70	„ Telephones ...		14 70		
32 40	„ Fire Brigade ...		34 50		
160 25	„ Police ...		251 50		
50 00	„ Boy Scouts, etc. ...		25 00		
464 73	„ Football ...		525 20		
363 40	„ Sundries ...		442 04		
474 64	„ Section Expenses ...		625 69		
74 81	„ Malayan Padi Competition ...		54 64		
138 00	„ Schedules ...		68 98		
	„ Malayan Rubber Competition ...		61 80		
	„ Special Coconut Section ...		509 23	$12,601 56	
$ 9,605 92					
	Balance being Gross Profit transferred to General Income and				
507 73	Expenditure Account ...			2,272 00	
$ 10,113 65				$ 14,873 56	

1934	INCOME.			
$ 5,201 33	By Gate Money ...	$ 6,915 20		
3,700 57	„ Stall Rents ...	6,702 00		
854 20	„ Prize Fund ...	864 00		
357 55	„ Commissions ...	392 36	$ 14,873 56	
$ 10,113 65			$ 14,873 56	

1934

Working and Income and Expenditure Account for the year ending 31st December, 1935.

1934	EXPENDITURE.					1934	INCOME.			
	To Stadium Expenses.									
$ 814 50	„ Upkeep	$ 1,229 03				$ 507 73	By Gross Profit on Exhibition			$ 2,272 00
404 78	„ Assessment	451 86	$ 1,680 89			3,500 00	„ Government Grants			5,900 00
						818 00	„ Subscriptions			1,023 00
536 35	„ Exhibition Ground Upkeep	...	1,009 74			20 00	„ Affiliation Fees			10 00
9 29	„ Bank Charges	...	38 85			2,141 28	„ Rental, Stadium and Exhibition Grounds ...			2,725 28
501 52	„ Printing and Stationery	..	292 80			115 28	„ Malayan Hampers (1934)			461 02
1,960 00	„ Salaries and Office Rent	...	2,040 00			102 55	„ Interest			139 83
200 00	„ Audit Fees	...	200 00							
126 10	„ District Shows	...	119 50							
264 25	„ Postages	...	308 17							
1,087 65	„ Debenture Expenses	...	— —							
159 63	„ Magazine	...	377 99							
166 07	„ Miscellaneous	...	171 32							
	„ Cookery Book	...	72 65	$ 6,311 91						
$ 6,230 14										
974 70	„ Balance being surplus on working carried down	...		6,219 22						
$ 7,204 84				$ 12,531 13		$ 7,204 84				$ 12,531 13
$ 2,880 00	To Debenture Interest	...		$ 2,867 50		$ 974 70	By Balance brought down			$ 6,219 22
1,638 24	„ Depreciations for year	...		3,031 91		3,543 54				
	„ Balance being excess of Income over Expenditure	...		319 81						
$ 4,518 24				$ 6,219 22		$ 4,518 24				$ 6,219 22

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THE
M.A.H.A. MAGAZINE
OCTOBER, 1936.

EDITORIAL.

Thirteenth Malayan Exhibition

Following customary procedure we include in this issue a report of the recent Malayan Exhibition held in Kuala Lumpur during the August Bank Holidays.

It was satisfactory to note the high standard attained by exhibits in the All-Malayan Padi and Rubber Competitions, as proving the practical usefulness of this method of organizing competitive classes. The suggestion has been made that the principle should be extended to include non-perishable exhibits in the Agricultural Section, and is receiving consideration by the Department of Agriculture.

The support accorded to the Trade Section was disappointing in view of its steadily increased growth during the past four or five years. The President, Mr. F. W. Douglas, at the opening of the Exhibition, ascribed this decrease to a wave of pessimism which, he suggested, had crept over trade in Malaya. If this is the explanation, it is a sad one: pessimism in 1932 and 1933 was understandable, if not commendable, but it should have no place in Malayan commerce in 1936, even if we are not enjoying " boom " conditions and making our fortunes.

Probably the exhibit to arouse most interest was the special display by the School of Agriculture, Malaya, of pure-bred poultry reared at the School at Serdang. The out-of-doors pens were continuously surrounded by a large crowd of visitors, who were not merely idle sightseers, however, as was evidenced by the constant stream of enquiries received by those in charge of the exhibit.

The birds displayed were convincing proof of the success attending the experimental work which has for some time been conducted at the School of Agriculture, a report of which was reprinted in the July issue of this journal.

Dried Skim Milk in Poultry Rations.

The results of this experimental work indicated the desirability of including a comparatively high proportion of dried skim milk in the feeding ration, and it may not be out of place to draw attention here to the unsatisfactory state of affairs—from the poultryman's point of view—which exists with regard to obtaining supplies of this by-product.

It is generally acknowledged everywhere that, provided it is properly balanced with carbohydrates, fats, minerals and vitamins (A and B particularly), there is no single foodstuff in existence to compare with skim milk in effecting growth in young animals, the reason lying in its high content of biologically good proteins. Yet we find that dried skim milk cannot be imported except under license from Government, and the sale of it is forbidden unless it forms a constituent of a mixed product.

It is obviously impossible and uneconomic for individual poultry-farmers to import their requirements, and it is to be hoped that Government will amend the present law so as to allow firms of repute to import stocks for retail sale to *bona fide* poultrymen. The alternative would appear to be for a trading concern to sell a " product " containing skim milk to which the poultryman could add the various other ingredients required.

In the latter case, the question of storage ability requires consideration, and may prove to be of considerable importance, if not difficulty. We are permitted to state that the Department of Agriculture is already investigating this problem, and that results to-date indicate that complete mashes rapidly develop acidity and rancidity under the normal conditions of storage in this country. Whether acidity and rancidity matter much in the case of poultry remains to be seen. That also is under investigation.

Vanda Joaquim Pests.

The Vanda Joaquim orchid is to be found in nearly every garden in Malaya and almost all gardening enthusiasts will have had experience of their flowers being destroyed by an insect before they have developed sufficiently to open. An article which we print in this number will, therefore, be of particular interest to nearly all our readers; it describes two insect pests of the Vanda Joaquim orchid and is contributed by Mr. G. H. Corbett, Government Entomologist, and Che Abu Hassan bin Sidong, Malay Agricultural Assistant.

In addition to the small grub which most of us have discovered on our orchids, and which is the larval stage of the beetle *Lema pectoralis* Baly, it appears that a thrips *Anaphothrips corbetti* Priesner, is responsible for the withering of the plants but, owing to its minute size, its presence is not often suspected.

Miscellaneous Horticultural Notes.

In this issue we introduce a new feature in the form of short notes of general horticultural interest. The notes deal principally with the successful introduction of well known plants to Malaya, and similar notes have appeared in past issues of this magazine. It is hoped, however, to enlarge the scope of the present series by making the notes of a more varied character, and readers are asked to contribute records of their successes—and failures—with plant introductions, and notes on any subject of gardening interest.

Mushroom Growing. We reprint in this number a further article from *The Malayan Agricultural Journal* on the padi-straw mushroom. We also include an abstract, very kindly made by a reader in British North Borneo, of an article which appeared in *The Philippine Agriculturist* describing the cultivation of the same genus of mushroom in Canton.

While, as stated on a previous occasion, successful results are not always obtainable, fairly satisfactory crops are being obtained in Province Wellesley, and some of our readers may be encouraged to experiment. If they do so, we trust that they will report progress through the medium of this journal.

Malayan Christmas Hampers. This scheme, now in its fourth year, might almost be termed a "hardy annual," and scarcely needs introduction. Particulars of this year's hamper, which has been reduced both in size and price, are published elsewhere in this issue. An alternative hamper in the form of a chest of tea is also obtainable.

The Malayan Agri-Horticultural Association.

THIRTEENTH MALAYAN EXHIBITION

BY

H. L. BARNETT.

The Thirteenth Malayan Exhibition, organized by the Malayan Agri-Horticultural Association, was held in Kuala Lumpur during the August Bank Holidays, the 1st, 2nd and 3rd August, 1936. Exceptionally fine weather again prevailed throughout the Exhibition, and the total number of visitors, 46,914 (including ticket-holders) far exceeded the 1935 total of 30,036. In 1934 the total was 22,588, and in 1933 20,093.

Although the Exhibition was actually smaller from the point of view of stall-holders and certain of the competitive sections, the accommodation provided was not reduced, so that the larger crowds of sightseers were able to circulate with moderate ease.

The Association was fortunate in obtaining two additional permanent buildings which enabled a change to be made in the lay-out adopted in previous years. In addition a permanent porch was erected of timber and shingles supplied by the Forestry Department, and a large space in the main building was reserved as a resting place, surrounding a fountain playing in an attractive lily pond.

The Opening Ceremony.

His Excellency Mr. A. S. Small, Officer Administering the Government, Straits Settlements, and High Commissioner for the Malay States, declared the Exhibition open at 11 a.m. on the 1st August, in the presence of a distinguished gathering which included H.H. The Sultan of Pahang and suite, H.H. The Raja Muda of Selangor, the Hon'ble the Undang of Rembau, and the Hon'ble the British Residents of Selangor, Pahang, and Negri Sembilan.

Mr. F. W. Douglas, President of the Malayan Agri-Horticultural Association, in calling upon His Excellency to open the Exhibition, commented on the fact that the area now occupied by buildings was twice that of the 1930 Exhibition. He also drew attention to the large increase in the number of District Shows. After referring to the reduced Trade Section which he considered due to a wave of pessimism which had crept over trade in Malaya, Mr. Douglas went on to appeal to Government to assist the small-holder to obtain the benefit of cheap money by taking over control of pawnshops and by some form of land bank.

In conclusion, Mr. Douglas said:

> **"I would like to place on record to-day the very great sense of loss which this Association felt owing to the departure of Dr. Tempany. His drive and co-operation were always an inspiration to us.**

It remains for me to express our thanks to the small army of voluntary workers who come to our aid every year. The success of our Exhibition depends on the work of so many people whom we are too apt to overlook because we so often only see the exhibit and forget the amount of trouble others have been put to. To all of these I can merely say—'Thank you'"

His Excellency, Mr. A. S. Small, reviewed the more salient features of agricultural conditions in Malaya during the past year. He said, *inter alia*,

"Thanks to the rubber regulation scheme, the rubber industry has shown a welcome recovery from the dark days of the slump. The scheme has worked smoothly and well, and during the last twelve months it has brought about a steady reduction of surplus stocks which has naturally resulted in a gradual rise in price to a figure which enables most properties to show a moderate profit.

Confidence in the future of the industry is being gradually restored, and this is indicated by the extent to which the owners of rubber properties are taking advantage of the provisions of the Rubber Regulation Enactment to replace the permissible percentage of old and less profitable rubber trees with new budded plants from high-yielding clones.

The Rubber Research Institute has continued to render valuable service to the industry. In addition to meeting numerous calls for advice in connexion with replanting programmes on estates, it has not neglected the needs of the small-holders. Since May, 1934, it has been building up a service of Asiatic instructors, to which four more officers have been appointed this year, bringing the total to 17. The value of the work of these instructors is well illustrated by the marked increase in the number and improvement in the quality of the exhibits of small-holders' smoked sheet which were to be seen this year at the local competitions and District Shows, constituting the first stage of the All-Malayan Rubber Competition. The winning exhibits in the first stage have been assembled at this Exhibition for the final stage, and you will be able to judge of their quality for yourselves by visiting the Rubber Research Institute's building. The small-holders' rubber smoking cabinets, which have been designed in various very cheap materials by the Rubber Research Institute and have been widely demonstrated throughout the country, have played a considerable part in rendering possible the progress made during the past year.

Coconut and Oil Palm.

"The position in the coconut and oil palm industries has fluctuated somewhat, but at present shows some improvement on that of a year ago. With increasing production of copra and other sources of vegetable oils, the general tendency is for supplies to exceed demand and for competition to remain severe. Other more temporary factors have, however, influenced prices. Thus the processing tax in the United States has encouraged the production of certain oils, formerly of little importance, such as sunflower seed oil, because they have been able to enter that country free of duty. Another effect of this tax has been to divert the Philippine copra supplies to the European markets, and the effect of this competition has been to depress the price of Netherlands Indies and Straits copra in Europe. On the other hand, there has been a considerable demand for glycerine, much of which is made from coconut oil, and this tended to strengthen prices. The shortage of supplies of animal fats and the increased demand for oil cakes caused by the drought in the

United States last year also tended to improve the price of copra, and this year's drought already seems to be having a like effect. Finally, an agreement which seems likely to be reached between Norway and the United Kingdom, limiting the production of whale oil during the present season, would also be a favourable factor.

Welcome progress has been made towards improving the marketing side of the industry. At last year's Exhibition it was announced that a Vegetable Oils Section of the United Planting Association of Malaya was in process of formation. The Department of Agriculture has submitted to it a scheme for the voluntary production and marketing under a Malayan Mark of a special grade of Straits copra. The scheme is based on the National Mark Scheme in the United Kingdom, the mark being the producer's guarantee that the product conforms to certain defined standards of quality. It is proposed that this scheme should be instituted on an experimental basis in the first instance in order to ascertain if there is a demand for the improved product at a profitable increase in price.

Copra Drying Cabinets.

"The Officer-in-Charge of Copra Investigations in the Department of Agriculture has also designed a series of copra drying cabinets, capable of producing copra of the best quality in less than 24 hours, for use on holdings of different acreages. They are all constructed of cheap and readily obtainable materials. Two will be on view outside the Department's building in this Exhibition. These cabinets have already attracted much attention wherever they have been demonstrated and have begun to produce their effect on the quality of the small-holders' copra. The improvement in the quality of this product that has taken place in the last three years has been very evident at District and State Shows. Recent reports from the Agricultural Officers in different parts of the country indicate that this improvement in quality is becoming widely recognised by exporters and is resulting in a definite improvement in the price obtained by small-holders.

Another advance that has been the outcome of recent propaganda is the installation in at least two coconut oil factories of refining machinery by means of which a very high-grade coconut oil is being produced.

Pineapple Industry.

"In the pineapple canning industry there has also been marked progress. Canning factories have been much improved and now conform to accepted standards of hygiene and sanitation. A canning officer joined the staff of the Department of Agriculture at the beginning of the year and has now received all the plant needed to enable him to commence his investigation work. Since his arrival he has established close contact with all the canners and been able to render them useful advice and assistance. Under his advice the canners have agreed to the gradual introduction of five standard sizes of cans in place of the numerous different sizes now in use. The Department of Agriculture has drafted and submitted to Government a scheme for the introduction, with the approval of the industry, of a Malayan Mark voluntary grading scheme for canned pineapples, which, like the copra scheme, is based on the National Mark Scheme in the United Kingdom.

The Rice Crop.

"The final estimate of last season's rice crop is not yet available,

but the figures already received indicate that it will be as good as, and probably better than, that of the previous season, though not up to the bumper crop of the season 1933-34. The Kedah crop was the largest ever recorded in that State, but unfavourable weather conditions reduced the yield in other parts of the country, notably in Province Wellesley and Krian.

Much has been done in the improvement of rice cultivation and in the settlement of new areas, such as those of Sungei Manik in Perak and Panchang Bedena in Selangor. The All-Malayan Padi Competition, now in its third year, has again been well supported and its effect on the quality of the exhibits will be evident at this Exhibition. Efforts to improve the yield and strain of the rice grown in Malaya have been continued and the three special officers appointed to the Department of Agriculture for rice research have now been at work for a year.

Tuba Root (Derris.)

"There has in recent years been a growing world demand for insecticides of vegetable origin which are comparatively harmless to man and the higher animals, to replace the more dangerous arsenical preparations. For this reason interest in tuba root has been well maintained on the world's markets. Tuba root has certain important rivals, notably the Cubé root of South America. Both plants show very marked variation in their toxic content according not only to the variety, but even the strain of each plant. The Department of Agriculture has been vigorously conducting investigations with tuba root and is now attempting to produce clones of high toxic content exactly similar to the now well known clones of high-yielding rubber trees."

The Hon'ble Mr. F. W. South, Acting Adviser on Agriculture, and a Vice-President of the Association, thanked His Excellency for opening the Exhibition, and took the opportunity of paying a tribute to the work of Lieut.-Colonel B. J. Eaton, O.B.E., the retiring Director of the Rubber Research Institute of Malaya.

The Exhibition was divided into three main groups: competitive sections, Government departmental exhibits, and the trade section.

Competitive Sections.

All-Malayan Padi Competition.

The All-Malayan Padi Competition inaugurated in 1934 is now well-established and has become largely a matter of routine. As explained in previous issues of this Magazine, the best samples from local Shows throughout the country are submitted for the Central Competition at the Malayan Exhibition at Kuala Lumpur in the ratio of three entries for every 10,000 acres of wet padi in each District or State.

State Shows, District Shows and local Padi and Rubber Competitions were held at forty-two centres during the several months preceding the Exhibition. The table below shows the distribution of these local Shows in the various States.

	State Shows	District Shows	Padi and Rubber Competitions
Kedah	1		
Penang Province Wellesley ..	1		4
Perak	1†	3	15
Selangor		5	5
Negri Sembilan		3	1
Malacca		2	1
Johore	1	3	1
Pahang			5
Kelantan	1		
Total	5	16	32

In the Central Competition, every State in the Peninsula, with the exception of Perlis and Trengganu, was represented. The total number of entries received was 139 distributed as follows:—Kedah 22 (17), Penang 3, Province Wellesley 9 (9), Perak 42 (39), Selangor 16 (15), Negri Sembilan 14 (12), Malacca 11 (12), Johore 3 (3), Pahang 17 (19), Kelantan 2 (—). The figures in brackets are for 1935, (total 126).

As shewn above, there was a small increase in the number of exhibits submitted for the final competition, although the number of original entries from which the final selections were made was, as in 1935, probably about 5,000.

The high standard of previous years was well maintained and there was a large number of entries with which little fault could be found. Preliminary selection reduced to fourteen the number of exhibits in the running for the six prizes, and these were judged on a basis of marking similar to that used in 1935 except that marks for " type of grain " were not allotted except in differentiating between two otherwise equal entries. Thus, with a possible maximum of eighty, marks were allotted as follows:—

1. Purity of sample	30
2. Condition and uniformity of ripeness ..	20
3. Condition and uniformity of grain	10
4. Weight per unit volume	10
5. Cleanness of sample	10
	80

Two exhibits tied on marks for first place with 78, but the first prize was finally awarded to an exhibit of Radin 13 from Raub (Pahang) as being a variety superior to the Nachin 756 from Sabak Bernam (Selangor) with which it was equal on other characters. The third prize went to Perak for

† Perak State Padi and Rubber Competition.

a pure strain Radin and the fourth to Malacca for a good exhibit of Siam 29. Fifth and sixth prizes both went to Negri Sembilan. A special prize was awarded to the 22 exhibits from Kedah as a group. Although winning no individual prizes, this State put up a very good selection of varieties suitable for milling, and as such varieties are of great importance to Kedah it was considered that the entry deserved recognition.

All-Malayan Small-Holders' Rubber Competition.

This competition was inaugurated at last year's Exhibition, and is based on the Padi Competition, selected prize winning exhibits from District Shows being finally judged at the Central Competition at the Exhibition.

This year, entries were restricted to exhibits of smoked sheet only; with cheap and efficient smoke houses now available it was felt that there was no longer any point in admitting air-dried sheet to the competition. The object of much recent propaganda has been to encouraging small-holders to smoke their sheet, and thus obtain a higher price, and this object would be countered if prizes continued to be given for air-dried rubber.

Each entry consisted of three sheets, and a total of 97 entries was received, as follows: Perak 22 (nil), Selangor 17 (20), Negri Sembilan 11 (12), Pahang 13 (3), Malacca 6 (1), Province Wellesley and Penang 8 (6), Johore 20 (12). The figures in brackets are the 1935 entries. Perlis sent three exhibits in 1935, but did not compete this year.

Judging was carried out on the same basis as last year, but, owing to the extremely high standard of quality reached by the exhibits, 100 points were the accepted maximum instead of 10 points, thus rendering possible finer discrimination in judging.

The scale of points was as follows:—

Freedom from over-smoking	10
Evenness of colour	10
Thickness	10
Freedom from:	
Mould and oxidation marks	20
Rust, bubbles and shortness	20
Specks and sand	30
	100

The exceptionally high standard reached by all exhibits rendered judging extremely difficult, and only by penalizing heavily quite minor flaws was it possible to grade the first six exhibits which were selected as follows: 1st Pahang 96, 2nd Negri Sembilan 95, 3rd Selangor 89, 4th Pahang 88, 5th Pahang 82, 6th Johore 80.

The judges commented on the fact that many of the exhibits which failed to win prizes were of first class quality, and there is no doubt that the competition has proved an unqualified success.

Agricultural Section.

The Agricultural Section was again housed in a large temporary building on the left of the main entrance.

The total number of entries received was 5,118, which represents an increase when compared with 5,155 in 1935, as the oils and fats classes were treated as a separate section this year.

The outstanding exhibit was again the collection of fruits and vegetables entered by the Cameron Highlands Society. So good was this exhibit that it was decided to award a gold medal as a special prize.

The large number of entries inevitably tended to overcrowding in spite of the generous size of the building allotted to the section, and the excellent results obtained as a result of the procedure adopted in the padi and rubber competitions would appear to indicate that some form of preliminary selection is advisable in the agricultural classes.

Oils and Fats Section.

This section, which was displayed at the end of the main building, replaced the Special Coconut Section which was a feature of the 1935 Exhibition.

Coconut oil and copra formed the principal exhibits, and although entries were not as numerous as last year, the quality of the exhibits shewed clearly the results of the work of the Department of Agriculture in encouraging the small-holder to produce good copra.

Entries of estate copra were as large as previously and maintained a high standard.

A feature of the section was the large number of locally-made soaps, most of which were attractively packed and of exceptionally good quality.

Other Competitive Sections.

The usual other competitive sections were organized on lines similar to those of previous years. One of the new permanent buildings was allotted to the Horticultural Section. The display of plants and flowers was one of the best staged in recent years, and great credit is due to the section secretary.

The other new permanent building housed the Preserves and Confectionery, Art and Photography, and Needlework Sections, and a school exhibit of handwork. In the first mentioned section there was a notable improvement in the quality of preserved fruits in syrup; a high standard was reached by several of the exhibits in the art section.

The Village Industries and Schools building provided, as usual, one of the most interesting sections of the Exhibition. Selangor and Kelantan both had State stalls, and exhibits from Trengganu were included in the latter stall.

Unfortunately the incidence of disease in Kuala Lumpur District made it impossible to hold the cattle and pig competitions, but the poultry section was organized as usual, although the number of exhibits appeared considerably lower than in recent years. The Cat Section was held on the last day of

the Exhibition, and here again, entries were rather fewer in number than formerly.

Department of Agriculture, S.S. and F.M.S.

A comprehensive exhibit was staged by the Department of Agriculture, covering copra, pineapples, rice, and Derris (tuba root).

High-grade copra was shewn, produced on the new types of high-speed kilns which have been erected and operated at the Coconut Experiment Station, Port Swettenham. There was also a collection of products manufactured from the coconut illustrating the many wide commercial uses to which this crop may be put. A display of coir articles was especially interesting since, in this country, little is produced and that little is of extremely poor quality. Two kilns of the new type were erected in the grounds.

The pineapple exhibit demonstrated the work which is now being undertaken to improve the quality of Malayan canned pineapples and to secure and extend the market for them.

Numerous examples demonstrated the work on selection which is in progress at the Pineapple Experiment Station, Singapore, to produce an improved type of pineapple for canning. There were, also, examples of graded canned pineapples demonstrating the proposed Malayan Mark Grading and Marketing Scheme, and many illustrations shewing the work which is being undertaken at the newly established pineapple canning research station.

Padi and rice exhibits were staged primarily with a view to instructing the padi-growing small-holder. They were in three sections shewing (1) milling of rice, (2) samples of pure strain varieties selected by the Department of Agriculture, and (3) typical faults in samples sent to local competitive shows.

The exhibit of Derris was designed to illustrate the production and uses of this root. The dry root was displayed, together with some of its products, including rotenone, the white crystalline toxic ingredient; other less-known derivatives and extracts were also shewn. The insect pests of tuba root exhibited shewed clearly that Derris poisons are not fatal to all insects.

An interesting exhibit from the Central Experiment Station, Serdang, illustrated the propagation of fruit trees by three different methods, *i.e.* marcottage, etiolation, and bud-grafting.

Departmental publications in English were on sale, and publications in Malay, Chinese and Tamil were distributed.

School of Agriculture, Malaya.

The exhibits of the School of Agriculture were in three groups: (1) photographs and propaganda film, (2) a selection of some twenty different varieties of vegetables grown by students at the School and (3) poultry.

The poultry exhibit was one of the most outstanding features of the Exhibition, and attracted considerable interest, two European officers and

three senior students being on duty the whole time and fully occupied in answering queries.

The exhibit was housed separately and attractively, covering an area of 1,000 square feet, and comprised two pens of pullets and an *attap* shed containing miscellaneous exhibits. One pen contained locally bred Rhode Island Reds, and the other, locally bred Light Sussex, each group being accommodated in a type of portable house evolved at the School, which can also be utilized as a day shelter.

The birds shewn were of the home standard of weight, and, apart from housing, the object of these two exhibits was to demonstrate the fact that approximate breed weight can be attained with locally bred pure breeds, provided that they are well fed from the moment that they are hatched. A further object of the exhibits was to demonstrate simple principles of sound management, particularly in relation to the prevention of disease.

In the *attap* shed were some excellent pure-bred cockerels raised at the School. There was also a locally-made brooder and rearing outfit, and a small laying battery which is being tested at the School.

The interest aroused by the exhibit as a whole can be gauged from the fact that several visitors subsequently went to the School of Agriculture after the Exhibition to pursue their enquiries, and the number of tentative orders for stock and hatchings of eggs exceeded the potential output of the School for the remainder of this year and whole of 1937.

The Rubber Research Institute of Malaya.

The Chemical Division of the Rubber Research Institute of Malaya staged various exhibits. In the centre of the building were two scale models (scale 1:6) of the "Subur" type of smoke house, which for some time has been the standard recommendation of the Institute. In addition, a new experimental apparatus for concentrating latex was exhibited, and worked at intervals throughout the whole period of the Exhibition. A further exhibit demonstrated the dangers of copper contamination of latex and rubber, and shewed how this could be avoided. Many enquiries were received regarding these exhibits, and members of the staff were constantly in attendance to answer questions.

The Soils Division exhibited samples of the chief Malayan soil types, and the fertility attributes of these were illustrated by means of profile cards. The distribution of the various soil types was seen from the geological map. Graphs were on view giving the results of manuring and cultivation experiments on rubber on different soil types. Many enquiries were received, chiefly in connexion with manuring and replanting.

As part of its Small-Holders' Advisory Service the Institute erected two typical small-holders' smoke houses, such as can be made for a few dollars and will pay for themselves in about a month through the increased price obtained for the sheet smoked in them. These two smoke houses were working continuously, with Asiatic Rubber Instructors in attendance

to explain their advantages. In addition, specimens of mangles suitable for small-holders were exhibited.

Medical Department.

The Public Health Exhibit was divided into two sections: (1) the Child Welfare Section, and (2) the Public Health Section. In the former, attention was drawn to the benefits of ante-natal care, the proper conduct of a normal labour and the rules of health in infancy and early childhood. For the Public Health Section a demonstration in the actual breeding of mosquitoes was given, in addition to showing modern methods in anti-malarial work. By means of numerous models the principles of modern sanitation were set forth, and attention drawn to the dangers of not carrying these out.

Other Government Departments.

The Posts and Telegraphs Department again provided telephone and postal facilities, and also staged a variety of interesting exhibits which continually attracted a large crowd of sightseers.

The Federated Malay States Railways displayed a 2nd class sleeping coach, advertising the facilities now available for travelling in comfort.

The Co-operative Societies Department, in addition to organizing the Village Industries Section, gave free cinema shows of propaganda films of agricultural interest.

Trade Section.

There was a disappointing decrease in stall-holders in this section, but stalls were, as usual, attractively designed and decorated. The models stall in this section was constantly surrounded by a large crowd, and the organizer is to be congratulated on the success of his obviously enthusiastic efforts.

General.

A rest-room for women was again provided by the Y.M.C.A. and was much appreciated.

A cycling carnival, badminton tournament and Malay " bangsawan " formed the amusement side of the Exhibition, and drew large crowds.

The Boy Scouts Association rendered extremely valuable services, and the police are to be congrafulated on their excellent traffic control, which was assisted very considerably by the parking arrangements of the Automobile Association of Malaya.

Acknowledgment

Acknowledgment is made of the assistance given by officers of the Department of Agriculture and of the Rubber Research Institute of Malaya in the compilation of this report.

Horticulture.

TWO INSECTS OF THE VANDA JOAQUIM ORCHID FLOWER

BY

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Government Entomologist,

AND

ABU HASSAN,
Malay Agricultural Assistant.

Enquiries are received from time to time regarding " worms " or " slugs " collected from the flowers of the Vanda Joaquim orchid and the following letter " . . . . . to enquire as to what I should apply to kill worms which have suddenly appeared in my garden and eat all the buds of my orchids, Vanda Joaquim and other ordinary orchids. I have tried by killing all I can find in the night by the light of a torch but the next morning I still find some more " has suggested a general account of two insects—one a beetle and one a thrips—which may always be found associated with the Joaquim orchid flower unless careful attention is bestowed to their control.

The so-called " worms " or " slugs " are the grubs of the beetle, *Lema pectoralis* Baly, which frequently devour buds, flowers and even flowering stalks of the Vanda Joaquim, Scorpion and other orchids. When the flowering stalk, however, is eaten, it is often replaced by a secondary flowering stalk. The beetles also feed upon the flower but their damage is not extensive, being limited for the most part to the edges of the flower or to circular holes in the petals. All stages—egg, grub, cocoon and beetle —may be found on one flowering shoot and, although seemingly more prevalent during April and May, beetles may be observed during every month of the year.

The Egg.

The egg is small but once recognised should rarely escape detection. It is generally seen within the cup but is also deposited on the lip and on the outsides of the flower as well as on the buds. It is usually laid singly, but several eggs in close proximity are frequently seen, and is generally deposited erect although it is often observed horizontal on the flower.

The egg is about 1.5 mm. in length and 0.7 mm. in breadth, dull yellow, cylindrical with both ends darker and rounded, and encased by a sticky fluid.

The egg hatches in from 3 to 4 days.

The Larva.

The larva is practically always hidden under a reddish or yellowish secretion and varies but little in appearance throughout its existence. The reddish-yellow covering begins to appear on the second day after the emergence of the grub from the egg and increases with its development.

The larva is soft, much wrinkled and, with the exception of the shiny black head, dorsal portion of the first thoracic segment and three pairs of short thoracic legs, is yellow. The body tapers towards both extremities and, fully developed, its length is about 14 mm. and its widest width 4 mm.

The larval stage, from the emergence of the grub from the egg to the commencement of the formation of the cocoon, may last only 6 but may extend to 9 days. In the majority of cases, however, the duration of the larval stage is from 7 to 8 days.

The Pupa.

When the grub is full-grown, it secretes a whitish frothy-like substance which subsequently hardens into a white cocoon inside which it transforms into a pupa. The cocoons are frequently numerous on the flowering stalks and stems of orchids and attract attention generally before damage to the flowers has been observed.

The pupa is found within the cocoon, is about 8 mm. in length and 5.0 mm. in width and is yellow in colour.

The cocoon stage lasts from 13 to 16 days; in the majority of cases 14 days. The grub within the cocoon is inactive for from 4 to 6 days when it transforms to the pupa.

The Beetle.

The yellow coloured beetle is very conspicuous and may be found on the flowers at any time during the day or night. It feeds to a limited extent on the flowers, but, if watched carefully, will be seen to be engaged more especially in depositing its eggs. The habits of the beetle have not been observed in detail and information is not available as to the number of eggs a female may lay. Eggs, however, may be deposited 4 days after the emergence of the female from the cocoon. The maximum life of the beetle recorded in the laboratory is 18 days.

The beetle is about 9.0 mm. in length and 4.0 mm. in width across the base of the wing covers. The head, antennae (11-jointed), first and

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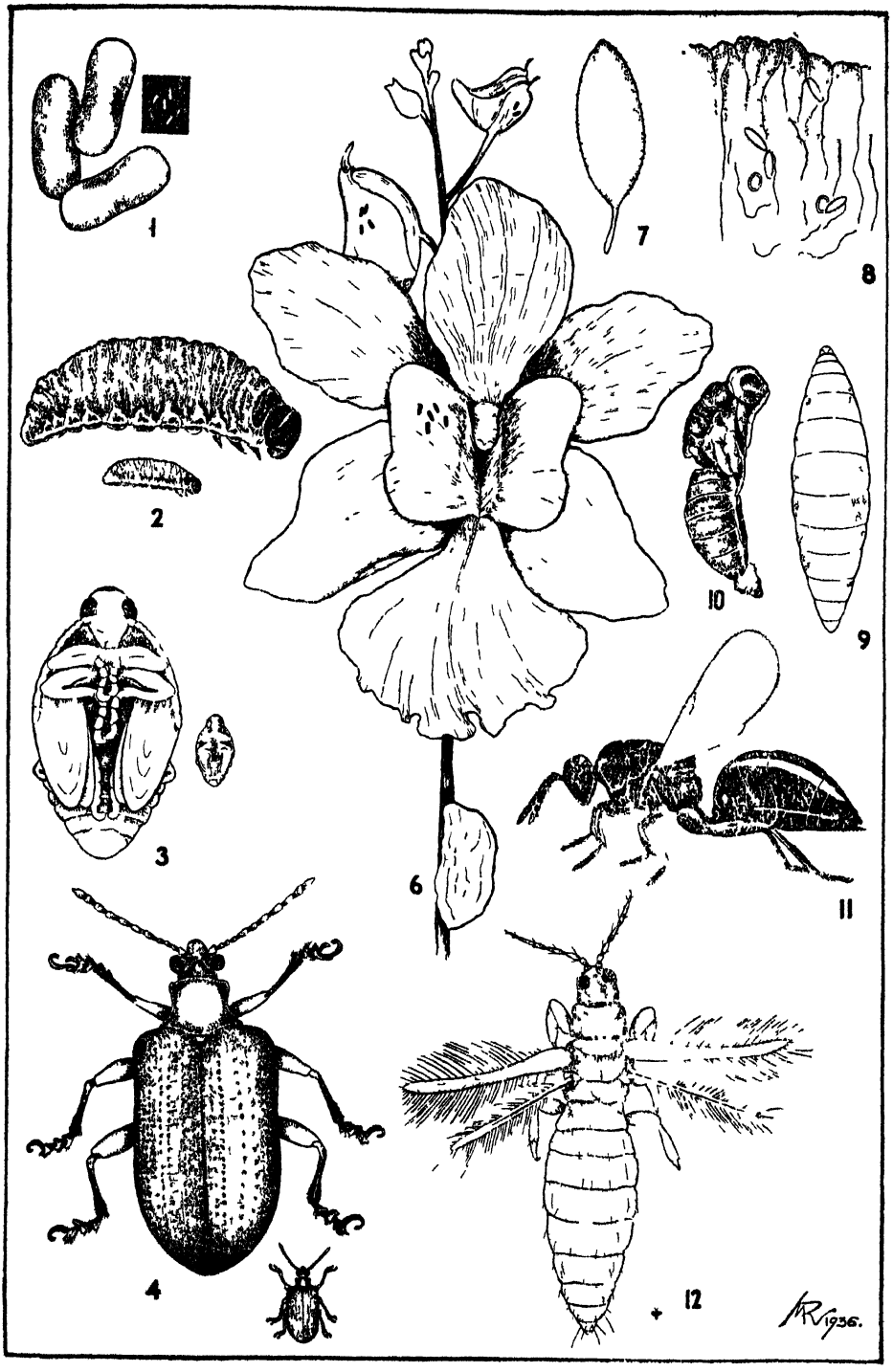
Explanation of Plate.

Fig. (1) Eggs, (2) Grub, (3) Pupa, (4) Adult of *Lema pectoralis* Baly. (Enlarged and natural size).
Fig. (5) Eggs of *Lema pectoralis* on flower and buds of the Vanda Joaquim orchid (darkened, natural size).
Fig. (6) Cocoon of *Lema pectoralis* (natural size).
Fig. (7) Egg, (9) Grub, (10) Pupa of the Chalcidoid parasite, (greatly enlarged).
Fig. (8) Eggs of parasite on body of larva of *Lema pectoralis*, (greatly enlarged).
Fig. (11) Parasite, (greatly enlarged).
Fig. (12) *Anaphothrips corbetti* Priesner, (greatly enlarged and natural size).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second thoracic segments and abdomen ventrally are orange, whilst the eyes, the third thoracic segment ventrally and the wings are black. The femora of the legs are mostly yellow and the tibiae and tarsi mostly black. The wing covers are yellowish green, conspicuously punctured, constricted at lateral margins and posteriorly rounded.

An Enemy of Lema pectoralis Baly.

An unidentified *Chalcidoid parasite* is very prevalent and has been frequently recorded emerging from the cocoon of *Lema pectoralis* Baly in Malaya. Whilst this parasite undoubtedly plays its part in preventing a number of grubs reaching the pupal and finally the beetle stage and may be responsible for the almost complete absence of this beetle at certain periods, its influence throughout the entire year is not marked.

The egg of the parasite is somewhat translucent, elliptical, about 0.3 mm. in length and attached by a pedicel, about 0.1 mm. in length, to the grub within the cocoon. The parasite probably lays its eggs on the inactive grub before the cocoon has hardened; as many as 15 parasites from eggs laid directly on the grub have developed and emerged from the cocoon of *Lema pectoralis*.

The eggs hatch in about two days into conspicuously segmented grubs which on a casual inspection appear to be orange. The grub, however, is translucent, its colour partaking of that of the food material derived from its host, the larva of the beetle. The grub of the parasite feeds externally on the larva of the beetle and when full-grown is about 3.7 mm. in length and pupates in from 7 to 8 days. The pupa is at first entirely creamy-like in colour and about 3.5 mm. in length. Subsequently, the eyes are red and the body black indicating the approaching emergence of the parasite. Many pupae of the parasite may be seen within the cocoon of the beetle close together and covered with some sticky fluid. The pupal period of the parasite lasts from 7 to 9 days.

The parasite is very small, black and with clear wings.

Control.

All stages of this insect are conspicuous on the flowers and flowering stalks of orchids. The eggs although small are easily visible, and after a little practice are readily observed within or without the flowers or on the buds. The larvae too, are rendered prominent by the reddish-yellow covering and the whitish coloured cocoons should never escape detection. The beetles are large and yellow and whilst some difficulty in catching them may be experienced efficiency in this respect will soon follow a little perseverance.

In the control of this beetle it is necessary, in the first place, to become acquainted with the appearance of the stages and subsequently to pass that knowledge to the gardener with instructions that all blooms must be examined daily and the stages collected and destroyed. The eggs may be squashed with the fingers but a small stick applied firmly will be found

more satisfactory in destroying the eggs without injuring the flowers. At the commencement of control, all badly eaten flowers and stalks on which grubs and/or cocoons are present should be removed and squashed with the foot or preferably burnt. In the writers' experience, the daily examination of flowers and the collection and destruction of all stages of this beetle are sufficient to ensure the production of perfect blooms and if flowers suffer subsequently through the agency of this insect the gardener has neglected to attend regularly to his duties.

When hand-collecting is recommended as a control for insects, satisfaction is rarely given—a spray is demanded. Tuba (1 lb. of root to 10 gallons of water) is used as a general insecticide and is undoubtedly an efficient spray for many insects in the garden but whether a satisfactory one for *Lema pectoralis* is doubtful. If, as alleged, it has proved successful, the flowers should be sprayed at least every third day (the incubation period of the egg) so as to kill the larvae on the day of their emergence. Lead arsenate (2 lbs. to 50 gallons of water) would be more satisfactory since once it has dried on the flowers permanent protection would be afforded them but, to protect opening flowers, spraying would have to be performed weekly.

Anaphothrips corbetti Priesner

Whilst the beetle, *Lema pectoralis* Baly, is generally well known throughout Malaya, this thrips, which is frequently responsible for the production of imperfect flowers and which at times is more destructive than the beetle, especially to the buds, has only comparatively recently been associated with injury to orchid flowers. In those gardens where tuba is regularly used resulting in the production of perfect orchid blooms, this is, quite unknowingly, probably due to the control of this thrips.

This insect is present on most Vanda Joaquim orchids and especially those which have been neglected. Its presence is revealed by small, malformed flowers with a brownish discolouration of the petals and, in severe infestations, by the buds turning yellow and black and by a brownish scaby appearance of the flowering stem. Those who identify the appearance of their orchids with this description will not find insects which are readily seen. The adults are black, very minute, only about 1.3 mm. in length, enlongate in shape, and, if examined through a lens, will be seen with fringe wings. If flowering stems are tapped on the hand or better on white paper, small objects, which until they commence to move may not have been considered to be insects, will be revealed. If movement of these " objects " is discerned, these undoubtedly are thrips which are responsible for imperfect flowers and for the death of the buds of the orchid plant.

The life-history of *A. corbetti* has not been studied but is probably similar to that of many other thrips, *viz*:—the female thrips cuts a slit with her ovipositor and lays her eggs singly within the tissue of the plant. Nymphs hatch from these eggs, suck the sap from the plant and, when full-

grown, enter the soil, change to pre-pupae and finally to pupae from which the adult fringe-winged thrips emerge. The adults as well as the nymphs suck the sap from the stems and developing flowers.

The Control.

In contrast to Lema pectoralis Baly, where *Anaphothrips corbetti* is responsible for malformed flowers, perfect orchid blooms will only be obtained by regular spraying, the more frequent the better, and once a week should be the practice.

Insecticides have proved to be satisfactory in the control of this thrips and the following have been successfully employed: soap (good laundry soap), ½ lb. to 1 gallon of water; tuba, 1 lb. of root to 10 gallons of water; nicotine sulphate (40 per cent. of nicotine), 1¼ teaspoonfuls to 1 gallon of water. One oz. of good laundry soap to one gallon of nicotine or tuba spray will render both these insecticides more effective.

Summary.

1. Brief descriptions of the beetle, *Lema pectoralis* Baly, and the thrips, *Anaphothrips corbetti* Priesner, both of which are responsible for damaging orchid flowers, are given.

2. For the control of the thrips spraying is recommended but for the beetle hand-collecting is advised.

THE ROMANCE OF KEW GARDENS

How may visitors to Kew have ever given a thought to the history and romance of Kew Gardens ? As we walk through the beautiful grounds and gaze with admiration at the Gardens' wonders, we accept it all as a matter of fact, for as far as we are concerned they have always been there, but here is a true history of Kew. It is condensed from " The Royal Gardens, Kew " by the Lady Rockley. (*The Listener*).

The Arboretum, Kew, was given by Henry V, 500 years ago for a Carthusian Monastery. It was originally a small lodge, later enlarged, and in 1721 became the property of the Prince of Wales who later became George II.

Queen Caroline, his wife, spent much of her time in the grounds, and large sums of money in beautifying the garden. Some of the trees she planted may still be seen.

One boundary of this property was a narrow lane known as Love Lane, and on the further side of Love Lane were several royal houses round which the real botanical gardens were started.

The first of these was Kew House which was bought by Frederick, Prince of Wales, in 1731. His wife, Princess Augusta of Saxe-Gotha, took the keenest interest in the Gardens, and both she and her husband also spent much time and money in adding to, and improving, the gardens generally.

After Frederick's death his widow's interest did not wane, and with the help and expert knowledge of Lord Bute she started a systematic botanical garden from which was evolved the Kew we know.

In 1759, William Aiton was appointed head gardener, and with him began the long line of famous botanists associated with Kew.

The same year Sir William Chambers was appointed to design hot-houses and other features. He was an architect and landscape gardener and he had travelled to China. His work was influenced by the Chinese gardens he had seen and the well-known Pagoda was part of it. This landmark is 163 feet high.

The original garden of the Dowager Princess of Wales covered 9 acres. To-day the gardens and buildings cover an area of 288 acres.

After the Dowager's death, Sir Joseph Banks, famous traveller and botanist, became adviser, a position he occupied for nearly 50 years.

In 1789 William Aiton published a list of the plants, and the *Hortus Kewensis* showed 5,500 species. He was succeeded by his son who saw several species added to this great work.

It was during Sir Joseph Banks' term of office that the important pioneer work was begun, sending out trained botanists around the world as collectors. Francis Masson was the first of these and his destination the Cape.

The next was David Nelson, and it is with the greatest interest that we read he accompanied Captain Bligh on his famous voyage to the Pacific Islands to collect the breadfruit plants for Jamaica. David Nelson was a victim of exposure when turned adrift by the mutineers of "The Bounty."

Many other botanists followed David Nelson, some travelling as far afield as Australia, China, and the Pacific Coast of America.

It is interesting to note that we owe to these travelling botanists such well known plants as the hydrangeas, tree peonies, tiger lilies, and many hot-house plants. Also the beautiful *Strelitzia Reginae* named after Queen Charlotte.

When the Queen died in 1818, Kew ceased to be a royal residence; Sir Joseph Banks died soon after her and Kew faded into insignificance for a time. When Queen Victoria came to the throne the fate of Kew hung in the balance. However, the crisis passed and in 1841 Sir William Hooker was appointed Director; from this time Kew's greatness steadily increased. Under his directorship one of the first steps was the opening of a part of the gardens to the Public. Another great advance was the influence of Kew then being felt overseas; men trained at Kew were given posts abroad in charge of Botanical Gardens, and the exchanging of plants began.

It was through Kew that quinine was introduced to India, and rubber to Malaya. Sisal and other fibre-producing plants and strange fruits were exchanged between East and West.

New plants, both living and dried, were arriving from every part of the world and the palm house was begun in 1844 to house them. Decimus Barton was the architect.

The pond in front of the palm house was a natural spring, but was deepened and enlarged to form a set design.

Sir William Hooker also superintended the pleasure grounds, but these were not opened to the public till much later. At this time his son, Sir Joseph Hooker, was taking perilous journeys into the Himalayas in search of plants. He succeeded his father as Director twenty years later. Some of his treasures were magnificent rhododendrons which will only grow out of doors in the mildest parts of Great Britain. In about 1862 a temperate house was built to show these delicate plants.

Near the temperate house stands the flagstaff, an enormous pine tree from Vancouver 214 feet high and weighing 18 tons. This was installed in 1919 to replace the original and somewhat smaller fir.

The terrace on which the temperate house stands was formed by earth taken from what is now the lake. The lake is fed from the Thames.

The rhododendron dell was made in George III's time; in May and June this spot is a magnificent sight not to be missed.

The rock-garden was one of the earliest in England and its plants have been collected from almost all the mountain ranges of the world. It was begun in 1882.

The famous giant water lily known as the *Victoria regia*, after the young queen, was brought from the Amazon in 1837. In 1850 it flowered for the first time in England and naturally caused a great sensation; the leaves of this plant are more than 6 feet in diameter and will bear the weight of a child.

One of the most recent additions to the beauties and novelties of Kew Gardens is the generous gift of a cactus house by Mrs. Sherman Hoyt. It is designed to represent the life of a Californian desert.

Visitors are not allowed in the Jodrell Laboratory where research work is carried out; nor to the Herbarium, but students from all parts of the world are admitted. The Herbarium houses about four million specimens and is the largest collection in the world.

The description 'dried plants' sounds dull to the unimitated but it is only by the study of these that plants can be named and classified.

The names Bentham and Hooker are well known in connection with Kew and it is to these two and other famous botanists that we owe the "Floras" of the various parts of the British Empire; a large number of such works have now been written but new discoveries add to our knowledge year by year, and the end is not in sight.

. . . . . .So, when next I visit Kew Gardens they will have for me added attractions. The ghosts of kings and queens will walk with me through the gardens. That glimpse of brilliant colour in the distance may not be an azalea bush, but the shimmering silks and satins of a queen and her maids. My thoughts will go back through the centuries and dwell on the romance of my surroundings; how gradually the royal garden lovers made their gardens which to-day have reached their zenith, and offer to the world a gift of unequalled beauty and magnificence.

D . I.

THE IRIS FAMILY IN TROPICAL GARDENS

BY

R. E. HOLTTUM, M.A., F.L.S.

Director of Gardens, S.S.

Many garden lovers must have wished that they could grow Irises in their tropical gardens. This is unfortunately impossible, but there are a number of other plants of the Iris family which can be successfully cultivated, a few of them with quite Iris-like flowers, but unfortunately these are very short-lived. Others are not very similar to an Iris in appearance, and a casual observer might think that they belonged to a different family; they show their resemblance in the arrangement of the parts of the flower, as explained below.

The Iris family is allied to the lily and Amaryllis families, and like them has the parts of its flower arranged in alternating whorls of three. In the Lily family there are 3 sepals, 3 petals, 6 stamens arranged in two alternate whorls of 3, and 3 carpels forming the ovary. In the Iris family the arrangement is the same, except that there are only 3 stamens. The genera Iris and Crocus are found in north temperature regions, but the remainder of the family is native chiefly in South Africa and Tropical America. Gladiolus, Freesia, Ixia, Montbretia and Sparaxis come from South Africa. The tropical American members of the family are less well known in horticulture, but two of them are worth growing in Malayan gardens. Among the few species of subtropical Asia is *Belamcanda chinensis*, the leopard flower, which is grown in Malaya.

Gladiolus. This genus provides some magnificent garden plants, and is the only one among locally grown Iridaceae which has been developed by hybridization. I do not here attempt to give a full account of Gladioli as it is hoped later to publish a separate paper on them. They are growing in popularity but still are not sufficiently widely cultivated locally.

The name Gladiolus means a little sword, and refers to the shape of the leaves. There are said to be 160 species, most of which occur in South Africa, but a few in Europe. The species which have been used for hybridization are almost all from South Africa. The *primulinus* hybrids, of which *G. primulinus* is a parent, are particularly suited to Malayan conditions, perhaps partly because the species in question comes from wet tropical country near the Victoria Falls. Even so, the altitude would be 3,000 feet above sea level, and it is not surprising that the plants are much finer on the hills than in the low country of Malaya. Here is a case in which selection by seed in the lowlands of this country might well produce a race more suited to local conditions. The flowers are very lovely, but they are also short lived, and if a race better adapted to a warm even temperature could be developed it might become one of the finest local garden plants.

There are few other flowers which have such lovely clear shades of colour, or a more decorative form.

Gladiolus plants produce corms, much like those of Crocuses, but of course larger. The corm is an adaptation to a seasonal climate, allowing the plant to rest during the dry season. In Malaya our climate is not very seasonal, and the plants need artificial resting. The corms when planted make rapid growth, and flower in two months or less. After flowering they continue to vegetate for a time, but as soon as the leaves show signs of browning the plants should be lifted and brought under cover, where they can be dried off. The tops should not be cut off until they are thoroughly dry, when they will come apart from the corm easily. Any small corms around the main one may be planted out at once and allowed to grow until they reach mature size. The dry corms should be kept under cover in a sand bed with their tops exposed until they begin to shoot.

Montbretia, more usually known to botanists as Tritonia, is another South African genus which has been much used in gardens, and a number of hybrids have been produced. They do not take so kindly to local conditions as Gladiolus. On Penang Hill Montbretias flower quite well, but in Singapore I have never seen flowers, though the plants will go on growing indefinitely. I believe that under favourable conditions (perhaps a sandy soil is one) Montbretias will flower under lowland conditions in Malaya, but I have not sufficient information on the subject, and would welcome observations from any reader who has experience of growing these plants.

Trimeza is a small genus native in the West Indies and South America. One species, *T. martinicensis,* is common in the Botanic Gardens, Singapore, and has spread to some places outside, but we have no record of the extent of its occurrence in Malaya. It is said to be common in Java. The date and manner of its introduction to the East is unknown, but it must have come by way of Europe. It was introduced to Kew from the West Indies in 1782, and is recorded as producing ripe seeds at Kew. It was illustrated in the Botanical Magazine in 1797, but was evidently not thought worth further attention by horticulturists in Europe.

In the Singapore Gardens it occurs in the grass in places where cutting is infrequent, especially under light shade. It seems to grow better with grass, which probably protects its roots from the sun, than in an open bed. The plants attain a height of about a foot, and are like slender miniature Irises in habit. The flowers are also similar to a small Iris in form, of a clear yellow colour. They are very decorative, but unfortunately short-lived, opening about 8 a.m. and beginning to wither about noon. If they could only be made to last a few hours longer they would be very useful for ornamental purposes. The most useful place for these plants in the garden is in rough grass that does not need to be cut very often, in light shade around trees. They seed freely.

Marica is a genus of a few species occurring in tropical Africa and America. *Marica Northiana*, native of Brazil, was introduced to cultivation in Europe before the end of the 18th century, and brought to England from Lisbon by a certain Mrs. North, after whom it was named. It was illustrated in the Botanical Magazine in 1803. The first record of an introduction to Singapore is 1882, when plants were brought from London. Plants are still to be found in the Botanic Gardens, but they are little known in general cultivation.

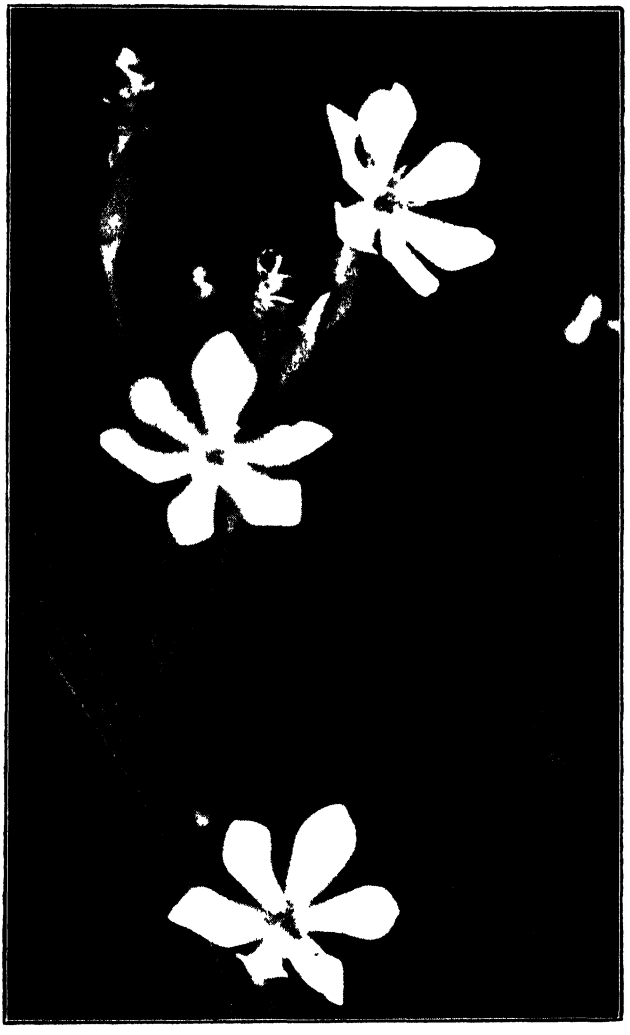
The plants are rather like small broad-leaved Irises in appearance. The flower-stalk is flattened, almost like a leaf, and bears a succession of buds which are protected when young by a sheath at the top of the stem. The flowers are of medium size and very beautiful, the three sepals white with yellow and red-brown markings in the basal part, the petals erect, the basal part yellow mottled with red-brown, and the apical part recurved, of a fine blue colour. If these flowers were produced freely and lasted longer they would be in every garden; but unfortunately they are not very freely produced, and they wither about 3 p.m. The plants are very easily propagated, producing suckers freely, and rooting also from the old flowering heads which finally bend over to touch the ground. They do not seem to set seed in Singapore.

Moraea is a genus found in Africa and Australia. One species, *Moraea iridioides*, is occasionally seen in Malayan gardens, and is probably the nearest thing to an Iris we can grow locally. It is a native of South Africa and was introduced to Europe in the middle of the 18th century. The earliest Singapore record in 1886.

The leaves are as much as 2 feet long, dark green, Iris-like but narrow. The flower is much like an Iris, white with yellow marks at the bases of the petals, and mauve styles. There are several colour varieties which have been recently introduced, but none of them have yet flowered.

Moraea flowers last longer than those of Marica and Trimeza, but they do not seem to be very freely produced, though the plants grow quite strongly. They seem to grow best in light shade, or with sun for half the day. The plants are not so easy to move or propagate as those of Marica. It is perhaps worth while introducing more varieties by seed from South Africa. There is also scope for experiment to find out under what conditions the plants flower best.

Eleutherine. This is a small genus native in tropical America. One species, *Eleutherine plicata*, is cultivated in Malaya. As suggested by the name *plicata*, the leaves are pleated, and are in fact quite similar to those of *Spathoglottis plicata*, the common ground orchid, and do not suggest the Iris family. The flowers are borne on slender stems about a foot long, in branched inflorescences. Each branch produces a sequence of flowers. The flowers are small and white, star-shaped, the petals and sepals very similar to each other, the three yellow stamens providing the only touch



Eleutherine plicata, about natural size.

Belamcanda chinensis, the Leopard flower.

of colour. The flowers open soon after 5 p.m. in Singapore, and remain open until some time during the night. By dawn next morning they are withered. This habit of opening more than an hour before sunset is a rather unusual one. Most evening flowers do not open until dusk.

Eleutherine plicata is a strong-growing plant, easily propagated by division, and reasonably free-flowering. Sometimes it flowers very freely, but we have not found out what are the necessary conditions for this. It likes a fully exposed place. The habit of opening at 5 p.m. is a pleasant one for those who like to spend the evening in their garden.

The species has been known in Europe since the early 18th century, and was described and illustrated in the Botanical Magazine in 1803. After the description, the account continues "Corolla expands with us (*i.e.*, in London) about sunset in March and April, and lasts about three or four hours. In Jamaica, where Swartz found it on the western aspects of the mountainous pastures, it flowers the year round about four in the afternoon."

Belamcanda chinensis or Leopard Flower. This plant is also sometimes called *Pardanthus chinensis*; Pardanthus means leopard flower, and is descriptive of the spotted petals. It is native of China, but has long been cultivated all over the eastern tropics and subtropics, and also in Europe and America. It is said to be even able to survive a mild winter in England.

The general appearance of the plant, before it flowers, is more like that of the common Iris than any other plant we grow in Malaya, but the flower stalks soon show it to be something quite different. The flower stalks are slender and much branched, producing a number of smallish orange flowers. The three sepals are considerably larger than the petals; they are spotted with a deeper shade of orange in the basal half only. The petals are almost in one plane, forming a star, unlike Moraea in which the petals are somewhat erect as in Iris.

Belamcanda grows very strongly and flowers quite freely and almost continuously in Singapore. The flowers open in the very early morning and last until about 5 p.m. In Singapore it sets no fruit, probably because of some unfavourable climatic condition. In cooler climates, the fruits are also decorative, displaying black seeds when they open. There seems to be more than one form, as our flowers are slightly different from those illustrated in the Botanical Magazine.

The rootstock is well known as a medicine in China; and is used for many purposes. In India it is said to be used as an antidote to snake bite, but probably has no more value as such than other plant products. It appears to be a fairly powerful drug, and it would be unsafe to eat much of it.

SOIL MANAGEMENT *

BY

J. C. NAUEN,

Botanic Gardens, Singapore.

Many difficulties confronting the gardener can be overcome by proper soil management and it is with the knowledge of the requirements of plants that this is best understood.

Normally a plant obtains its food from two sources: (i) the air and (ii) the soil. From the air a plant obtains carbon, oxygen and hydrogen; from the soil, water, nitrogen and minerals.

A plant feeds by absorbing soil moisture through its roots and pumping it up, through its tissues, to the leaves. In the leaves the nitrogen and minerals, brought from the soil by the water, combine with the various gases obtained from the air to form tissue and other plant requirements.

In dealing with the materials a plant obtains from the soil, water is the most important, for it is the agent by which all food is transported. The amount of water taken up by the roots of a plant is tremendous. As an example we might take the case of the potato plant. It has been estimated that up to 800 lbs. of water passes through the tissue of a potato plant in the forming of 1 lb. of dry material.

The mineral requirements of plants, though small in comparison with other requirements, are very essential. They must always be available in quantity and kind, a deficiency of any one mineral seriously jeopardises the growth of a plant. Excessive amounts of any one will not make up for the deficiency of others. Fortunately most soils have a sufficiency of minerals with the possible exception of potash, phosphate and nitrogen.

Although four-fifths of the atmosphere is made up of nitrogen, plants can not take it up in the form of a gas. Only after it has undergone several changes, in combination with other substances in the soil, is it at all available to plants as a food. Nitrogen is brought to the soil in various ways; dead animals and plants, manure and other organic substances return it in large quantities and are for this reason beneficial in improving soils. Nitrogen is, however, principally brought to the soil through the activity of myriads of bacteria, living in the soil, which possess the power of abstracting it directly from the atmosphere. These micro-organisms are only active in well aerated soils, which points out the importance of good cultivation and drainage. Artificially, nitrogen may be added to soils in the form of nitrate of soda, sulphate of ammonia and other similar manures.

Potash is usually fairly plentiful in most soils, especially clay, but in an inert form. Good cultivation and the application of some form of lime will convert it into such form suitable to plants. Potash may be

* A paper read to the Singapore Gardening Society, August 1936.

added to soils artificially by manures. The ash of a garden fire before it has been washed out by rain is rich in potash.

Phosphate is seldom present in soils in sufficient quantity and must therefore be added. Although certain amounts are yielded to the soil in organic manures this supply should not be relied upon. Bone meal, superphosphate and rock phosphate are the usual forms in which phosphates are added to the soil.

One of the best agents for liberating inert mineral foods is lime. Lime although a good plant food in itself has the power of liberating other plant foods. It is also a means by which heavy soils can be made more friable. When there is a large quantity of lime in the soil other manures are not required in great quantity. Excessive liming must, however, be guarded against, as, through the liberating of an excess of plant food the soil will be impoverished. Lime should be applied to the soil at the rate of 1 lb. to 5 square yards and its action should last many years. Lime should not be dug into the soil but sprinkled on the top and allowed to percolate through. Gypsum and other forms of lime may be applied with equally good results.

The various minerals essential to plants have separate and definite action on the growth of plants. Nitrogen tends to produce luscious growth. Potash aids in the strengthening of the tissue and in the production of fruit etc. Phosphates assist in the production of good root growth, disease resistance, and the production of flowers and fruits. From this knowledge it is possible to make up an ideal mixed fertilizer.

1. Early growing stages of a plant:
   - 1½ oz. superphosphate
   - 1 oz. nitrate of soda or sulphate of ammonia
2. Medium stage of growth:
   - 1½ oz. superphosphate
   - ½ oz. sulphate of potash
   - 1½ oz. nitrate of soda or sulphate of ammonia
3. Later stages of growth:
   - 1½ oz. superphosphate
   - 1 oz. sulphate of potash

The above mixtures are sufficient to mix with one kerosene tin full of water and apply to 3 to 4 square yards soil. For pot plants the mixtures can be diluted slightly and applied at the rate of one cigarette tin full to a twelve inch pot, once a week or ten days. It is important to note that the manure should not be given until the plants have become established and also to discontinue manuring when the flower buds appear. The mixtures do not apply to permanent plants.

In making up flower beds drainage is one of the essential points which must be regarded. Without good drainage the mechanical condition of the soil is soon lost and the all-important soil bacteria become inert. Beds should be dug at least three feet deep, the bottom nine to twelve inches

being filled with broken bricks or rubble. The mixture of soil put in the beds should have mixed with it a further lot of broken brick; sand or ashes may be used instead. Leaf-soil is also excellent material and should be used at every opportunity.

The pot cultivation of plants as practised in Singapore is a good example of the importance of good drainage. The burnt earth used has no food value whatsoever and merely acts as a good open medium. It depends upon the amount of manure and other material mixed with the burnt earth how strong a plant will grow; of course, after the burnt earth has become weathered it will have some food value. The best way in which to manure pot plants grown in burnt earth is a little and often, this will allow the plants to absorb a regular supply.

In conclusion it may be suggested that only phosphates should be given to the soil in the form of artificial manures. Potash and nitrogen, suitable as plant food in the soil, are dependant more upon the mechanical condition of the soil and an adequate supply of organic matter, rather than on applications of expensive fertilizers.

THE TREES OF SINGAPORE *

BY

R. E. HOLTTUM, M.A., F.L.S.

Director of Gardens, S.S.

Malaya is a land of trees, more so perhaps than most of us realise. Trees bulk so largely on the landscape that we are perhaps a bit inclined to take them for granted: but if we pause to think what Singapore would look like without trees we may perhaps realise what trees mean to a Malayan city and its surroundings.

The green of foliage, chiefly the foliage of trees, is in fact one of the most distinctive features of the local landscape; and the beauty of that landscape is largely dependent on the varied form of the trees, the varied texture of their foliage, and the occasional beauty of their flowers. In this short address I can only touch upon a few aspects of the trees of Singapore, dealing more especially with the trees which have been planted in the city for purposes of shade and for their beauty.

Ideal Conditions.

First a few words about Malayan trees in general. The reason for their abundance is of course climatic. In Malaya we have a climate which is favourable for growth throughout the year. There is no dry or cold season when trees must rest. Trees have therefore the most favourable climatic conditions for growth, and they have taken advantage of it not only by producing the great numbers of individuals which form the forests of Malaya, but by producing a vast number of different kinds.

A comparison with Europe will be interesting. In a flora of the country within 100 kilometres of Paris, 46 kinds of trees are enumerated in a total of 1,238 kinds of plants altogether; that is less than 4 per cent.

About 30 years ago, Mr. Ridley made a list of the kinds of plants found in the island of Singapore. There were about 1,900 kinds in the list, and about 620 of them were trees, or 32 per cent. In the Malay Peninsula as a whole, so far as we know at present, there are about 7,000 kinds of plants, of which more than 2,000 are trees; and every year new discoveries are added to this list.

These figures will give you some idea of the wealth of trees in Malaya. But most of these trees are forest plants, and they are not happy in the open, away from the shade which protects their roots from the heat of the sun and maintains the uniform conditions of the forest soil. They are therefore not suitable as plants for the town, for roadsides and for gardens.

* An address delivered to the Rotary Club of Singapore.

Planting in Towns.

We plant trees in the town for their shade, for the beauty of their shape, of their foliage, or of their flowers, or sometimes for their fragrance.

The size and shape of the tree must be suited to the position in which it is to be planted; where shade is especially required, trees of spreading habit are selected; for narrow roads, trees which are not too tall; for wide roads, tall and stately trees; for gardens, trees which are specially decorative and not too large; for screening purposes, trees which attain the desired height and have abundance of leafy branches from top to bottom; for special points on the landscape, very tall trees of fine shape.

Not all suitable trees have showy flowers, and for the sake of variety a mixture of flowering and foliage trees must be selected, especially as most of the finest flowering trees are not of a very large size.

Important Factors.

There are also various factors which have to be considered as disadvantageous for town planting. Some trees lose their leaves and stand bare for a time (these are not many in Singapore). Some shed their leaves in such abundance as to be a nuisance. Some have large heavy fruits, either hard or soft, neither of which are desirable in roadside trees.

Others trees produce such large or long surface roots as to be troublesome in the neighbourhood of drains and pavements. Some grow too large for street planting; some have soft wood and are not very safe. Some will grow only in a particular type of soil. Some grow very slowly and so take many years before they serve the purpose for which they are planted.

All these factors have to be considered in selecting trees for planting. The question of propagation is another important one. There are a few trees which might well be used for roadsides or gardens much more abundantly than they are at present, but because they do not produce any seeds under local conditions, and cannot be propagated by other methods, no stocks of them are obtainable.

Malayan Climate.

The effect of the uniform Malayan climate on trees is an interesting study. Most Malayan trees are evergreen. They produce new crops of leaves at varying intervals according to their nature, the older leaves gradually or suddenly falling and sometimes surviving two or more crops of new leaves. The flowering of these trees is dependent on dry weather, which in Singapore is very uncertain in its appearance.

Now in countries with a regular seasonal climate, such as those from which most of our imported trees come, the trees all lose their leaves together once a year, always at the same season, and the flowering follows. Thus in India and other countries, the Poinciana and the yellow Cassia trees all flower together and make a wonderful landscape effect. But in Singapore our dry seasons are so short and so erratic that they are no guide to the trees.

The result is that some of the trees ignore such changes as we have, and simply lose their leaves when the leaves are so old as to be no longer serviceable; they usually start to grow new leaves almost at once, without a bare stage.

To take Poinciana as an example, the Flame of the Forest. The leaves seem to be serviceable for about ten months, after which they are changed; but as there is no prolonged bare stage, the tree gets through a year's normal development in ten months; it lives at a faster rate than usual, on account of the Singapore climate which gives it no rest.

A further result is that if a tree grows its new leaves in March one year, the process will occur next year in January, and again in November; then next year in September, and so on. Another tree may produce new leaves three months after the first, in June, April, February and December successively.

Thus we have a succession of different trees changing their leaves and flowering in succession throughout the year, but never all flowering together.

Locally Planted Trees.

I will now say a few words about some of the most characteristic of locally planted trees. First, Malayan trees. The Angsana trees along Connaught Drive, planted about 1890, succumbed rapidly to a mysterious disease about 1918, at which time they formed a magnificent avenue. All that remains is a small group of trees close to the Anderson bridge. The disease took its toll of most of the Angsana trees in Singapore, and because of its deadly attack no more have been planted in recent years.

This is a great pity, because the Angsana is undoubtedly the finest large avenue tree now planted in Malaya, as those who have seen the magnificent avenues at Penang and elsewhere will agree.

The Angsana is native from the Peninsula south-eastwards to New Guinea. It apparently grows near sea coasts, and is not at all common in Malaya. It is deciduous, and produces a magnificent display of golden flowers with the new leaves.

The Tembusu.

The Tembusu is perhaps the best known of local trees used for ornamental planting in Singapore. It is a tree of secondary growth on hard clay and wet soils, and appears in quantities on some of the waste ground in the neighbourhood of the town. It is evergreen, and its decorative value lies both in its graceful form and foliage, and in its fragrant flowers which are produced in such abundance in May.

The simultaneous flowering of all tembusu trees in Singapore is one of the few phenomena of the kind, and it seems remarkable that there can be a stimulus so definite and so regular as to bring this about.

Observations I have made seem to indicate that the stimulus is the

rather sudden change from the wet season to drier weather which usually occurs in January.

The dry weather sometimes does not last very long, but it seems that a week's drought following a period of wet weather is enough to set the tembusu trees going. The result is a heavy flowering about four months after the change from wet to dry.

This seems a remarkably slow response, but the tembusu flowers, though not large, are very slow in developing.

The other most commonly planted local tree is the Jambu laut. This is essentially a tree of seashores, and was adopted in 1882 for roadsides in the rural part of the island. Until the recent programmes of road-widening were undertaken, all the rural roads were lined with avenues of Jambu laut, but now the only road which gives any idea of how they looked is the Kranji Road. The trees are large, fairly quick in growth, not very particular as to soil conditions, and flower pleasantly two or three times a year. Their flowering is not quite so markedly simultaneous as that of the tembusu trees. Some of the old trees that remain in the town are rather miserable specimens owing to drastic pruning and root cutting, but a well-grown tree is a fine sight. The flowers are quite like those of Eucalyptus, to which the Jambus are related. The fruits are not fleshy, like those of the edible Jambus, but they are much eaten by bats.

Flame of the Forest and Tulip Tree.

The best known of all flowering trees in Singapore is the so-called Flame of the Forest, or Poinciana. This species was first found by Europeans in Madagascar in 1824, before which time it only existed in a small part of that island. Its great beauty led to its rapid adoption for ornamental planting in all parts of the tropics and sub-tropics where the climate is warm enough. It probably reached Malaya in the forties, by way of India.

The name Flame of the Forest is really more appropriate for some other trees, as Poinciana is not a forest tree. The French name Flamboyante is perhaps the most suitable, or flame-tree, though there are other flame-trees in Australia and elsewhere. The name regia or royal was given to this tree on account of its great beauty.

The African tulip tree, Spathodea, is another exotic which is much planted locally. It comes from tropical West Africa. Its rapid growth and its fine clusters of large cup-shaped orange-scarlet flowers make it an attractive and useful tree; it is also evergreen, and flowers almost continuously. It is, however, soft-wooded, and sometimes dies back badly, presumably owing to some change of soil conditions. A fine tree is a magnificent sight, but unfortunately too many of the trees in Singapore are not of the finest. On Penang Hill, tulip trees grow less tall, and flower more freely. Some of them are very beautiful.

Indian Trees.

The commonest Indian trees planted locally are the Indian Laburnum

(*Cassia fistula*) and the Pipal or Bodh tree (*Ficus religiosa*). The Indian Laburnum is sometimes also called, very appropriately, " Golden Shower." It is native in the plains of northern India, and is not quite at home in Singapore. Most of the trees which I have observed are like the Poinciana; they change their leaves about every 10 months and so flower at a different time in successive years and different trees do not always flower together. Sometimes, a tree flowers very beautifully; sometimes less freely; perhaps the weather at the time of leaf-change, or just before, is responsible for these differences. As a tree for the garden, *Cassia fistula* is hard to beat, except that for a few months before the leaf change, the old leaves are often very dull and untidy.

The Pipal tree is a contrast to the Cassia. It is grown for the beauty of its shape and foliage, not for its flowers, which are inconspicuous. It is also grown because it is a sacred tree to both Hindus and Buddhists.

Like the Cassia it is a deciduous tree, and not too happy in our climate, which gives it no rest. The trees are very irregular in their leaf-changes, though in India they change every dry season. Old Pipal trees seem to be particularly suitable for the growth of epiphytes, ferns and orchids, which often cover the branches in masses and are very picturesque though perhaps not too good for the tree. The leaves also, as they rustle in the breeze like poplar leaves, are very attractive. The small seeds of the tree are freely distributed by birds, which eat the fleshy fruits. The seeds often germinate in the crevices of brickwork, and will in time disintegrate old buildings if they are allowed to do so.

South American Trees.

From South America come the Rain Tree and the Jacaranda; also the Honduras mahogany and a few other locally grown trees. The Rain Tree is a very useful shade tree, of fine shape and quick in growth. It is practically evergreen in Singapore, though in some countries it stands bare for a time at the leaf change. The flowers are pleasant though not large. The fruits are said to make good cattle fodder. As with the Pipal, old Rain trees are favoured by epiphytes, the masses of which are often very beautiful. The leaves have an unfortunate habit of going to sleep some little time before sunset, and they give the trees a rather mournful appearance, especially young trees which have not yet acquired a dignity of size to counteract this impression. Some 12 years ago, the Rain trees of Singapore were suddenly attacked with great violence by an insect pest, which did serious damage and even killed some of them. It appears that the pest was imported from southern India, perhaps indirectly. Since then, the pest has apparently come under the control of local natural enemies and parasites, and is no longer so serious though it is still abundant. Rain trees seem to need a well-drained soil to grow their best, and many of the specimens in Singapore are stunted as compared with the fine trees one sees in Kuala Lumpur and elsewhere.

Jacarandas are useful for gardens, or where trees which are not too large or spreading are required. Their delicate foliage and their flowers are both beautiful. But again they are not quite suited to our climate. Their nature is to lose their leaves, and then to flower on the bare branches before the new leaves come. They are very erratic in their behaviour, and often change their leaves on one branch at a time; they also require good soil to grow well. The result is that Jacarandas are rarely seen to perfection in Singapore.

The above remarks will illustrate the varied behaviour of different trees in our climate, and some of the difficulties of selecting suitable trees for planting. A large number of the old trees in the town have been cut down in recent years owing to necessary road-widening, and some have suffered through lack or room for their roots. In many cases it is not possible to replace the old trees, owing to lack of space, and to the presence of telephone cables and other necessities. On the other hand, much new planting is being carried out on new roads, which are being planned so as to allow for tree planting as a part of the scheme. It is to be hoped that in the not very distant future these avenues will be an attractive feature of our city. But it is not merely planting that is required; subsequent care is needed in the matter of pruning; and the trees need to be protected from damage by thoughtless persons. Irreparable damage may be done to a young tree (or even an old one) by casual hacking which is sometimes done thoughtlessly but is none the less destructive. There is much to be done in the matter of educating the general public in the care of trees, and in creating a civic pride in the trees which should be one of the chief beauties of our city.

MISCELLANEOUS HORTICULTURAL NOTES.

Cynoglossum, Sutton's Annual Blue.

This charming annual has proved suitable both for bedding and pot culture under local conditions, being easily raised from seeds and flowering some twelve weeks after sowing. Normally the plant grows to eighteen inches high, bearing its deep blue flowers in small clusters at the end of subsidiary branches, the whole resembling somewhat the forget-me-not. The leaves are tongue-shaped and covered, as are other parts of the plant, with soft hairs which impart a soft feeling. It is from the leaves that both the botanical and common names of the plant arise: Cynoglossum = Hound's Tongue.

In soil and cultural requirements the plant is not fastidious and it will succeed well under the general treatment given to other annuals, responding well to fertilizers. One point in its cultivation is however, important. The seedlings must be transplanted when quite small; unless this is done the plants will flower prematurely and give disappointing results. In pot culture, three plants to a nine inch pot have been found ample to give a good display, while in bedding, the best results have been achieved from plants planted from 6 to 9 inches apart.

The plant mentioned in this Magazine, Vol. IV No. 2, as *Anchusa myosotidiflora* has proved to be a Cynoglossum, probably the Indian *C. furcatum*. Other Cynoglossums are worth trying.

Perennial Phlox.

It is pleasing that this old English garden favourite has succeeded as a pot plant in Singapore, for, apart from sentimental reasons, it is a plant worth growing because of the lasting qualities of its flowers and the innumerable colours into which they run. Under local conditions the plant has to be treated as an annual, since, if allowed to grow on after flowering, it becomes straggling and non-productive. Propagation is by cuttings of side growths, rooted in sand, which will produce flowering plants in little over six months. Cultivation is similar to that practised with other pot plants although it is well to remember that the plant has a liking for a rich, sandy soil which is not allowed to become too dry at any time.

The flowers of the plant are very similar to those of the annual Phlox and are produced in terminal clusters, resembling somewhat the Hydrangea. The supporting stems are sparsely clothed with leaves, and grow to two feet in height, though often the plants will not grow more than one foot before flowering.

Mites.

One of the most troublesome pests which attack short-lived flowering plants, causing a stunting of growth and the malformation of flowers, is mites. These almost microscopic animals will always be found in great numbers on the growing tips and on the underside of the leaves of the affected plants, curling and discolouring them. Although various sprays have been tried at the Botanic Gardens, Singapore, to combat this pest, none have proved to be of outstanding merit. Sulphur, in dust form, on the other hand has been used effectively in checking their progress and as a preventative measure. The sulphur was dusted on the plants by means of a dust gun or powder puffer while the plants were covered with morning dew. The first application was given while the plants were in the seedling stage and further applications were given at intervals of from ten to fourteen days.

Sulphur is a well known fungicide and is used extensively in the control of mildews.

J. C. N.

Bud Variation in Hibiscus.

Mrs. Ingate, of British North Borneo, sends us an interesting history of a bud variation in Hibiscus. On a bush of the common double pink Hibiscus, some branches bear flowers of a much deeper *vieux rose* colour; the latter colour is one not seen by Mrs. Ingate previously in the district. The bush in question formerly belonged to another owner, who writes: "I believe I had it at least five years, and for three or three and a half years it had only what I called double salmon coloured flowers. Then I was amazed to see a double red flower appear and at first thought there must be two shrubs in the same spot, but on investigation I found a small branch on the original shrub bearing the red flowers."

Authentic records of bud variation are always interesting, and are not very frequent in this part of the world. It seems probable that the Louis Wathen Bougainvillea arose by bud variation from Mrs. Butt, and one might expect the same variation to occur again. Louis Wathen shows an almost complete lack of the purple pigment found in Mrs. Butt, whereas in the Hibiscus above mentioned the new variation has a deeper colour.

Seeds of Clematis.

The commonly cultivated Clematis, which appears to be *Clematis triloba*, native of Southern India, is usually propagated by cuttings, but it may also be grown from seeds. The seeds are freely produced, and are nearly all good. The only drawback to propagation by seed is the long time which the seeds rest before germination. It appears that three months is a common time to elapse after planting before germination occurs, and some seeds may take longer.

R. E. H.

Cuphea Miniata.

The genus *Cuphea* (natural order Lythraceae) consists of about 200 species of herbaceous plants or small shrubs, all natives of tropical or sub-tropical America, particularly of Mexico. A few of the more decorative species and their varieties are grown as conservatory plants and occasionally as summer bedding plants in temperate climates.

Recently Mrs. G. Woods of Kuala Kangsar (to whom the writer is indebted for the information supplied in this note) imported seeds of *Cuphea miniata* from Thompson & Morgand Ltd., of Ipswich. These were sown and the seedlings treated in the normal way, exposed to full sun though sheltered from rain. In due course some of the plants were potted and others transplanted to a mixed bed in the open, where they flourished, flowered freely and spread by means of rooting branches.

One of the pots, given to a friend, ultimately came to the writer who was much impressed by the abundance of brilliant cinnabar-red flowers delicately marked inside with violet-blue.

The plant appears to be exceptionally easy to grow well, provided it is given full sun. After only a few days' shading flowering declines rapidly. It seems to like a rich, rather light soil and abundant manuring (pieces of groundnut cake were used with great success) together with dry weather, though free watering is necessary. Propagation is made by seeds or soft young cuttings, the latter rooting very freely in a week or ten days in a mixture of sand and coconut dust, or in sand alone. No difficulty has been experienced in growing the young plants rooted in this way.

Mrs. Woods is to be congratulated on the introduction of a very beautiful annual which promises to be really hardy and useful locally as either a pot-plant or for bedding. Some of the other species and varieties would be well worth introducing " on trial." In particular *C. platycentra* (= *C. ignea*), the " Cigar-flower " and the horticultural variety " Scarlet and Gold " mentioned by Suttons as " far the most showy and valuable of the entire class " deserve an effort to get them established in this country.

Martynia fragrans.

This annual, a native of the warmer parts of North America was also recently introduced by Mrs. Woods who reports excellent success with it as a pot-plant. The seeds are slow in germinating, but young plants come on rapidly, and, at their best, Mrs. Woods' plants carried up to a dozen flowers each at a time. The flowers are large, dull reddish-purple in colour, inconspicuous from a distance, but striking when seen nearby. Some plants bedded out were not a success, a fact possibly accounted for by a wet spell experienced shortly after planting. It is stated in Bailey's *Standard Cyclopedia of Horticulture* that the young seed-pods of Martynia can be pickled like young cucumbers.

Two Unusually Good Varieties of well known Plants.

Seeds of *Dianthus laciniatus splendens* and of the Marigold known as "*Dixie Sunshine*" were recently obtained from the Editor, "My Garden" (34, Southampton St., London W.C. 2) by Mr. E. D. Butler. Both have proved unusual and excellent varieties. The Dianthus has large single flowers of a very rich crimson with a small white eye and appears to be free-flowering and well suited to local conditions. The Marigold, which grows to a height of about two feet, has a golden-yellow spherical inflorescence with a pretty fringed edge.

A Record of the Flowering of True Lilies on the Plains.

Some months ago Mr. A. H. Millard of Kuala Lumpur received a dozen bulbs of *Lilium longiflorum giganteum* and two bulbs each of *L. auratum platyphyllum* and *L. speciosum magnificum* from England. They were potted immediately on arrival in an ordinary potting compost and kept sheltered from rain in a bungalow-porch. Some of the *L. longiflorum* plants were destroyed by an insect pest which bored the stems, but all the lilies which escaped flowered within two or three months. The flowers were rather smaller, and the plants generally less robust than would be the case in a more suitable climate; nevertheless, they had the true lily scent and were very beautiful. While one can hardly hope to establish true lilies and obtain more than one flowering on the plains, the fact that it is possible to obtain flowers at all is of interest, particularly as bulbs can now be obtained at very reasonable prices. (*Note*: True lilies should not be confused with Crinums and Amaryllis or Hippeastrums which are commonly called Lilies).

Bougainvillea "Mrs Butt."

One frequently sees and hears this variety of Bougainvillea referred to as "Madame Butt." Presumably it is imagined that the variety was named in honour of Madame Clara Butt the singer, but this is not the case. The variety was named in honour of Mrs. Butt of Jamaica, through whom, it is believed, the variety was introduced to horticulture. The writer met Mrs. Butt in Jamaica and understood that she found it some years before on the mainland of Central or South America whence she brought it to Jamaica. In due course it reached England where it was recognized as a new and valuable variety and where it was named officially in honour of the discoverer.

B. A. L.

Miscellaneous.

MUSHROOM CULTIVATION IN THE CANTON DISTRICT

An interesting article entitled " Construction of Mushroom Beds in the Canton Region " by Rafael B. Espino, appears in the February issue of *The Philippine Agriculturist*.

The author is a professor of plant physiology, and in the summer of 1935 went as Exchange Professor to the Lingnan University in Canton.

It was during this period that Mr. Espino visited the district round Canton, and his observations on the cultivation of edible mushrooms make instructive and encouraging reading. The original article is profusely illustrated but unfortunately it is not possible to reproduce these illustrations.

Mushroom cultivation in Canton is carried out on the farmsteads or in the fields of the Chinese farmer and grown in rotation of crops. The mushroom beds are exposed to the elements, thus differing from the method of cultivation in Europe where the mushrooms are usually grown in caves. The actual construction of the Canton mushroom beds is also different.

Rice straw is necessary for the construction of the mushroom beds and spawn from old beds is used. Strangely enough no manure is used although the Chinese farmer is notorious for the generous manuring of most other crops with night soil.

To increase the heat and set up fermentation in the mushroom bed, peanut cakes are often inserted in the sides of the bed about 40 days after spawning.

Throughout his article Mr. Espino emphasises the fact that skilled labour is essential, both for constructing the beds and for watering them; in the latter case a whole crop may be ruined by injudicious watering. Excessive watering may cause unduly low temperatures or wash away fungus spores and broken mycelia, and insufficient watering will set up firing or heating in the straw bed.

Four efficient men working on six beds can earn 80 cents* a day, working from sunrise to sunset. Apparently few tools are used. Two long bladed spades, a dipper with a long handle and a portable Chinese foot pump were the only implements seen in the mushroom fields. The pump works on the principle of a series of two endless chains to which shallow buckets are attached, and is used for irrigation work.

Each bed of standard size (approximately 7 meters long by 80 centimeters wide) requires 15 piculs of rice straw. This straw costs about 60 cents a picul. There are two qualities of straw used, fine and coarse, and the coarse straw from the lowland rice fields is preferrable to the finer. The coarse straw is used at the bottom of the bed and the fine on

* Canton currency is implied throughout the article.

top. One old bed for spawn costs about $44 although spawn is available in smaller quantities at about $5 a picul.

There are two mushroom harvests each year and these coincide with the Chinese national festivals, the Moon Festival on or about September 12th and the Dragon Festival on or about June 5th.

The first harvest's spawning is done on or about April 8th and the second spawning on or about July 26th. In order to avoid the Canton winter the last planting is done not later than August 15th and the crop is all gathered in early in October before the cold north wind comes. The crops are gathered twice a day, at 4 a.m. and 10 a.m. respectively. The author was told that one bed may yield as much as 50 kati of fresh mushrooms.

There are two species of mushrooms grown in the Canton district, the large dark ones and the smaller white ones. The larger is said to be a species of *Volvaria* similar to, if not identical with, the Philippine Island edible mushroom, *Volvaria esculenta*. The Canton species of *Volvaria* is sensitive to the heat of the sun and grows rather sparsely, whereas the smaller type, which is probably a species of *Coprinus*, can stand the sun better and produces a more reliable crop, having a heavier yield and growing in thick groups and clusters.

Mr. Espino observed four essentials for the success of a crop: suitable sites, clean dry straw, good spawn and skilled labour. Sites are usually selected where irrigation water is available. The soil chosen is fairly heavy, the kind suitable for rice culture when well watered, and for truck gardening when drained.

The actual construction of the mushroom beds is given in full detail, and even without illustrations should be sufficiently clear to any reader wishing to try mushroom growing, even if only experimentally as the present writer intends to do.

(a) The soil foundation of the beds is first made. These beds are usually built in pairs side by side with a space between of about 70 centimetres. The dimensions of the standard beds are approximately 7 metres long, 90 centimetres wide and 20 centimetres high, but the length may vary according to the topographical conditions of the land selected for the crop. A shallow ditch is dug along each side of the foundations and about 50 centimetres away from them. These ditches act as reservoirs and are at times allowed to flood right up to the soil bed.

(b) Next, the mushroom spawn is evenly distributed along the outer edges and ends of the foundations but not down the middle.

(c) The first layer of hanks of rice straw is next laid across the bed forming a continuous layer over the spawn, the butt ends of the straw hanks all lying the same way and all untidy and loose ends tucked in to fit the width of the bed. (A " hank " is one bunch of straw, *i.e.* about two handfuls not necessarily tied together).

(d) A second layer of straw hanks is laid over the first layer, also

across the width of the bed with the butts lying along the opposite side. Again stray ends of straw are tucked in.

(All the straw used in the construction of a mushroom bed is first trampled into the water in the shallow ditches previously mentioned for about ten minutes in order to make it soft and pliable before use).

(e) The second layer of spawn is now distributed in the same manner as the first layer—see (b)—and a thick layer of straw is spread uniformly over the whole bed, but this time the hanks are laid along the length of the bed. At this stage a man walks along the full length of the bed gently trampling it while another walks alongside the bed and waters it with a long handled dipper of water as the trampling proceeds. When water begins to ooze from both sides of the bed this process ceases.

(f) Next comes the fourth layer of straw covering the centre bed, and this time it is again laid across the width of the bed, stray ends folded in, and butts all lying the same side.

(g) A fifth layer of straw is laid directly over the fourth, also across the width of the bed and with butt ends lying along the opposite side.

(h) The third layer of spawn is distributed on the fifth layer of straw in the same manner as the first two layers of spawn, and finally covered with a rather thicker layer of straw hanks than previously, the straw again lying the length of the bed.

The bed now consists of an earth foundation, three layers of spawn and six layers of rice straw.

(i) The final process is the temporary cover which consists of hanks of straw tied at the butts and placed over the whole bed in the form of a rough hayrick cover. In fact the completed mushroom bed resembles a long, low hayrick.

The bed is left for a week without watering when the temporary cover is then removed, trampled into the ditches and made soft and pliable, and again placed on the bed, but it is pulled apart and put loosely over, completely covering the bed. The internal temperature of a bed should be about 57 degrees centigrade. When conditions demand, that is when there is no rain and humidity is low, the mushroom beds must be watered. The author tells us that the success of a mushroom crop appears to depend almost entirely on frequent rain and high humidity of the air, but even a mushroom crop like any other crop may fail and yield little or no harvest. Poor spawn and attack by earthworms may also cause the ruin of a whole crop. The Chinese farmers have successfully treated attacks by earthworms with a mixture made from tobacco poured on to the soil foundations and area around in liberal quantities.

When the mushrooms are mature and ready for harvesting they appear amongst the straw where the spawn was distributed. To gather the mushrooms the straw covering is gently raised or pushed aside.

Mr. Espino's article is a most encouraging one, and given the right

spawn and conditions generally there seems no reason why at least an attempt should not be made throughout Malaya and North Borneo to grow these edible mushrooms. The article was written with the hope that it might help to arouse greater interest in mushroom cultivation in the Philippine Islands and we should like to think that the author's hopes will be fulfilled.

D. I.

MALAYAN CHRISTMAS HAMPERS

Once again preparations are being made by the Malayan Agri-Horticultural Association for the supply of Malayan Christmas Hampers.

This year, as an experiment, the size of the hamper has been reduced, and the price also reduced to $10. The contents will, of course, be of Malayan origin, and will comprise:

2 lbs. Boh Plantations tea.
2 lbs. Aucutt's coffee.
1 tin canned pineapple.
1 Brazil nut fruit.
1 bottle Chutney.
1 Malacca work-basket.
1 Kelantan silver belt-buckle.
1 pewter tea-strainer.

An attractively designed card of greetings giving the name of the sender will be enclosed in each hamper, and a copy of it will be forwarded to all senders of hampers.

Arrangements have been made, this year, for an alternative hamper in the form of a 5 lb. chest of Boh Plantation tea, delivered from stocks in London at an inclusive charge of $5.90.

The last day for receiving orders for the Malayan Hampers is the 31st October, and full particulars and order forms can be obtained from the Secretary, 8, Barrack Road, Kuala Lumpur.

THE PADI STRAW MUSHROOM IN KEDAH *

The culture of the padi-straw mushroom, *Volvaria volvacea* (Bull) Quel, was described by J. A. Baker in the *Malayan Agricultural Journal* for December 1933. It has recently been discovered that the fungus occurs naturally in Kedah and has long been known to the Malays as "*kulat jerami.*"

Following the publication of the article referred to above, the Department of Agriculture introduced spawn of the mushroom from Province Wellesley and from it raised a few specimens in a specially prepared bed of padi-straw in Alor Star. After the harvest early in 1934, another bed was formed at the Telok Chengai Experiment Station and sown with spawn from the original one. Owing, it is thought, to rather dry weather conditions, not a single mushroom was produced. The straw from this sterile bed was subsequently scattered over the padi field in which it was situated and ploughed into the soil.

As it was hoped to obtain a large supply of spawn from the bed, a considerable quantity of straw was collected in the Station and made into a small stack to provide material for further experiments. The stack was roughly covered with '*atap*' to keep out rain and preserve the straw; it was not disturbed in any way. The temporary roof decayed in due course and rain-water entered freely. Following four months of heavy rainfall—July to October—the straw partially decayed.

At the beginning of November, exceedingly fine specimens of Volvaria, which were often six inches, or more, in diameter, commenced to be produced near to the base of the stack. As the mushroom grew without the artificial introduction of spawn, it was evident that it had occurred naturally.

When specimens were shown to Malay padi-planters they immediately recognised them and could recall numerous instances when supplies of the fungus had been collected from heaps of straw used for bedding for live-stock and other purposes, or left undisturbed in the field after the padi had been thrashed. In order to confirm these statements investigations were made in the Kota Star District in the month of November and many examples were discovered on large heaps or stacks of straw.

The fungus appears to be indigenous and widely distributed. Under natural conditions fruiting bodies are produced chiefly during the long wet-season which, in Kedah, extends from June to November. The mushroom is much prized as an article of food, especially by Chinese; as it can be dried successfully it can be preserved indefinitely.

* By W. N. Sands, Principal Agricultural Officer, Kedah. *The Malayan Agricultural Journal*, Vol. XXIII, February, 1935.

During the long wet-season the fungus could, without doubt, be cultivated and produced in quantity, and also in drier months of the year, provided close attention were paid to watering and the shading of the tops and sides of the beds to maintain humid conditions. It is now considered that partial, or complete failure to grow the mushroom in the past has been due, more particularly, to the absence of suitable protection from sun and wind.

The photograph, Fig. 1, shows the mushroom growing near to the base of a heap of padi-straw, and Fig. 2, the characters and general appearance of the fungus. The specimens shown in each photograph were produced on straw that was freshly collected in the field after harvest, and no spawn from a previously infected source, such as a cultivated bed, was mixed with it.

FIG. I. *Volvaria volvacea* growing naturally on padi-straw.

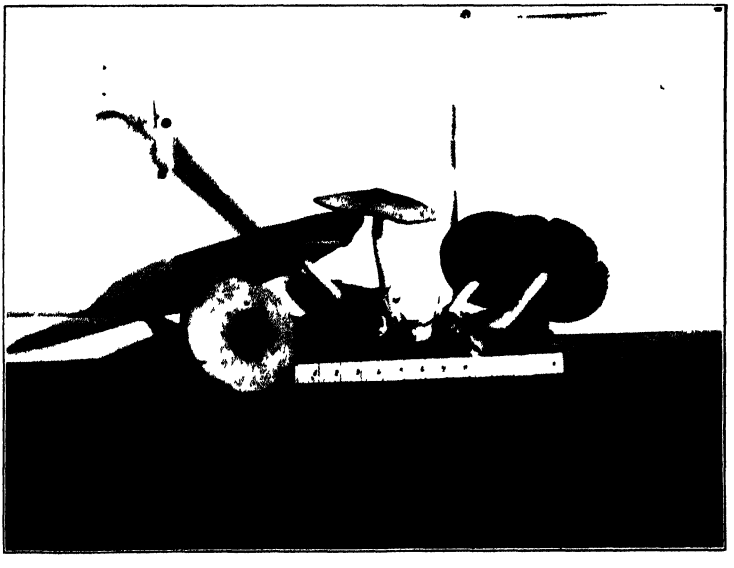


FIG. II. Specimens of *Volvaria volvacea* showing general characters.

Poultry.

MUSCOVY DUCKLINGS

BY

DOREEN INGATE

Practical experience teaches one more than all the theory in the world and this applies as much to poultry rearing as to anything else.

Only three years ago I knew nothing whatever about duck rearing: in fact, I had never seen a Muscovy duck. There is still much learn, but the little knowledge already gained has been entirely by experience.

The friend who supplied my original drake and two ducks gave me some information on the rearing of these birds. Subsequent reading of books and papers on the subject corroborated the fact that Muscovy ducks should rear their own ducklings. In this respect my experiences were a complete failure. Although a proportion of the eggs hatched, the mother ducks were so clumsy that they trod on the young ducklings and killed them; others developed cannibalistic tendencies and ate them. Out of about forty eggs we brought one duckling to maturity—a drake.

Another factor to contend with was the persistency of the mother in remaining on her nest after hatching the eggs. A wire pen was put up outside in which she was placed with the sole survivor of her brood, but she repeatedly flew over the top and back to the house regardless of the cries of the small duckling. We decided to let hens rear all future broods.

Our next experiment was to allow the Muscovy duck to hatch the eggs, but, when they chipped, the eggs were given to a broody hen to hatch off. With this method our results have been about 80 per cent. hatched and 70 per cent. reared.

Another experiment was to allow a hen to perform the complete process of sitting, hatching and rearing. I had been told that this would be unsuccessful as nature required Muscovy ducks' eggs to be kept moist, the moisture being maintained by the mother duck's bath. As a substitute I sprayed the eggs with tepid water but the eggs did not hatch, probably owing to ignorance as to how often to spray, the optimum temperature, and quantity of water.

The next experiment was dry hatching under a hen. However, when the eggs chipped they were slightly moistened with tepid water, as in some cases the feathers of the young ducklings stuck to the membrane of the shell and dried so that they could not release themselves. This moistening enabled the bird to be readily released.

The incubation period of Muscovy eggs is from thiry-four to thiry-six days, and it is commonly believed that a hen cannot manage such a long period. This is a fallacy, but the hen should certainly be given a regular

supply of fresh water and raw green vegetable chopped up, or cucumber, as she tends to become anaemic. I have never had to change a hen owing to its inability to sit out the allotted period.

Now I adopt both methods of hatching the eggs, under a hen (10 eggs) and under a Muscovy duck (13 or 14 eggs). In both cases a hen rears the ducklings.

My method of feeding the young ducklings is to give them boiled rice, chopped raw green vegetables and a little water to moisten, for the first week or ten days. A separate vessel of drinking water is provided but should not be deep enough for the ducklings to bath in. An enameled plate serves the purpose.

A moveable pen is used as the ground daily becomes damp. This pen is sheltered from the rain and in our case is put under the verandah of the bungalow. Our ducks are very susceptible to rheumatism and are not allowed out in the rain until they have grown their second feathers. The pen should be placed to catch the maximum amount of sunshine.

After a week or ten days, dried fish chopped fine is added to the ducklings' food. I find the best fish for this purpose are the tiny dried fish (*ikan teri*) as the larger fish have dangerous bones.

Some of my young ducklings developed the habit of feather-eating—not their own—but this can usually be cured by adding lime to their drinking water; feather eating is due to a lack of lime in their diet. In some cases in a small brood I have cured persistency in feather eating by dressing the victims' feathers with a home-made unguent of vaseline flavoured with quinine.

After about three weeks a shallow pan for bathing is provided for the ducklings. A kerosene tin cut lengthwise and the edges beaten down makes an excellent bath; this should not be too deep, so that the ducklings can get in and out without difficulty.

If the bathing causes rheumatism the bath is removed for a few days and the legs of the affected ducks rubbed with a good household liniment once a day. In the case of ducklings over a month old a quarter tablet (5 grains tablet) of aspirin may be given with discretion on alternate days. The ducklings should be kept dry. After a cure has been effected the bathing pan may again be used.

My ducklings sleep in a wooden box in the kitchen at night, with a layer of straw changed daily. As they grow the straw is discarded, the mother hen supplying sufficient warmth.

Muscovy ducks are very intelligent, and when the mother hen leaves them the ducklings easily and quickly adjust themselves to new conditions. They are then driven each night into the poultry house and penned off from the adult ducks until full-grown, as Muscovy ducks seems to be the greatest bullies in the whole poultry yard.

Muscovy ducks make very little noise compared with the persistent

quacking of the ordinary runner duck and when full-grown provide three times as much meat.

Anyone taking up Muscovy duck breeding as a hobby, as I have done, will, I am sure, not be disappointed. They are intensely interesting from the time they hatch until full-grown; some become very tame and friendly.

Since taking up the rearing of Muscovy ducks I have entirely given up breeding runner ducks.

BACK NUMBERS OF *THE M.A.H.A. MAGAZINE*.

Limited supplies of most back numbers of *The M.A.H.A. Magazine* are available and can be obtained on application to the Secretary, 8, Barrack Road, Kuala Lumpur; price 30 cents per copy post free.

"HENS EGGS EXPLANATION"

We are indebted to a reader for the following advertisement by a poultry breeder in China who shall remain anonymous. We trust that it will prove of interest—and instructive—to readers struggling with poultry problems in this country. [Editor].

* * HENS REARING GROUND.

Fresh Leghorn Hens Eggs Explanation.

It is well known that egg is the best food, and the best egg is which laid by a Leghorn hen. But it must be fresh and of the best quality, for a good Leghorn egg contains the properties of phosphorus, calcium, magnesum, iron, nitrogen, oxygen, hydrogen and carbon, the eight important material elements and vitamine to human body. We rear Leghorn hens by a new scientific way, and our eggs are the best in market, which are so nourishing to human body, and not the common eggs can be compared with. We may explain some of their prominent points in the following:—

1. According to new scientific way, we use rice powder, flour bran, grains, vegetables, potatoes, beef-crumbs, fish-crumbs, shrimp-crumbs, cow-bone-dust, and cod liver oil for our hens' food which causes the eggs contain rich and nourishing material elements.

2. We use proper basins to hold our hens' drinking water which we disinfect once and change thrice daily, which causes no impure fluid in our egg (egg contains more than 70% water).

3. We constructed porper basins sheds for our hens, and pay more attention to the flock's health; as, the cleanness of the sheds, giving purgative to the hens weekly to purge their bowels. Our hens are so healthy, and never affect with any disease, and the eggs laid by them are therefore guaranteed no microbe.

4. Those sheds have skilfully been constructed according to the up-to-date style which are mostly airy and spacious, and are proved to be satisfactory for the flock's residence. It is for this reason that the animation of our hens have always been found prosperous, and the eggs which laid by them are recognized to be of perfect and nourishing.

5. We keep our hens from cocks, and their eggs receive no semen, and would not hatch or become rotton under a warm weather. We also send them out to market directly, and so they are guaranteed always fresh.

6. Owing to the supesiority of our hens' derivation, both the size and weight of every egg is proved to be exalted above those that are being sold in the common market, of which, however, we further guarantee to possess the most nutritious substances.

From the above explanation, our customers would easily find our eggs are quite different with those common ones in the market. For their hens are not properly reared, no proper food to feed, proper shed to keep, let shem drink impure water, keeping with the cocks, paying no attention to their health. Their eggs are not nourishing and always contain with impure substances, and harmful microbes. For the above exolanation, we heartily beg our customers will pay attention to it.

* * HENS REARING GROUND,
* *
* * Swatow, China.

Selangor Gardening Society.

QUARTERLY NOTES.

Visit to Forest Research Institute, Kepong.

The Gardening Society visited the Forest Research Institute, Kepong, on August 10th., when Mr. E. J. Strugnell kindly took members round the Institute and explained the research in progress. The Society acknowledges with thanks the kindness of the Forest Department and Mr. Strugnell for a very pleasant meeting.

Thirteenth Malayan Exhibition

Mr. Chew Sze Foong was in charge of the Horticultural Section of the 1936 Exhibition, in which many members of the Society entered prize-winning exhibits. Of especial interest was an unusually fine group of Celosias staged by Mr. L. Y. Swee, and the first flowers of a new hybrid orchid (*Arachnis alba* × *Renanthera coccinia*) exhibited by Mr. R. E. Holttum, Director of Gardens, S.S. The spike exhibited resembled *Arachnis alba* closely except in the colour of the flowers which was similar to that of the *Renanthera coccinia* (a shade between vermillion and crimson). Mr. Holttum also exhibited a new hybrid *Spathoglottis* (*S. affinis* × *vieillardi*).

General.

Elsewhere in this number, members will see a note on *Cuphea miniata* and *Martynia fragrans*. Many similar introductions have been made by enthusiastic individuals in the past, but, as there was no convenient means of preserving records, much valuable information has been lost. A note to the Editor, to Mr. Holttum in Singapore, or to the Secretary of the Gardening Society, will enable records of interest to be kept in this magazine for future reference. Notes of successful treatment of plants are also of value. A permanent record is not only of interest, but may save others the trouble and expense of importing plants which will not succeed, or may lead to the re-introduction of valuable garden plants which have been previously grown but are now lost.

B. A. L.

Singapore Gardening Society.

QUARTERLY NOTES.

The need for a Gardening Society in Singapore has been evident for some considerable time for, although there is quite an interest taken in gardening, there is a general lack of co-ordination between the practitioners and a want of a better understanding of the practical points of the subject under local conditions. That there is no lack of interest in the formation of the Society has been evidenced by the fact that no less that seventy-five members were enrolled within three months of the inauguration meeting.

The first general monthly meeting of the Society was held at the Chamber of Commerce, Singapore, on Monday 6th July 1936. As befitted the occasion, the opening address was given by Mr. R. E. Holttum, who was instrumental in forming the Society and who has been elected its first President.

The second monthly meeting was addressed by Mr. J. C. Nauen, on Soil Management. There was an excellent attendance, and many questions after Mr. Nauen's address, the substance of which is printed in this Magazine. There was also a good show of plants and flowers.

For the remaining months of the year, an attractive programme has been formulated, as follows:

September 14th. Short addresses on Cannas, their origin, cultivation uses, pests, hybridization: by various members.

October 12th. Mr. F. Flippance: "Garden Planning."

November 9th. Mr. John Laycock: "Orchids."

December 14th. Mrs. H. R. Arbenz: "Flower Arrangement."

Besides addresses, competitive exhibits of flowers and plants will be arranged at each meeting under the following headings:—

1. New and rare plants
2. Orchids
3. Pot plants, flowering
4. Pot plants, foliage
5. Cut flowers.

The judging of these exhibits will be done by ballot, each member being entitled to one vote in each class and the final awards made, according to a score, on the number of votes recorded in favour of an exhibit. It is hoped to award a Society's certificate or medal to the winners in each class at the close of each Society's year.

J. C. Nauen,
Honorary Secretary.